Multimeter
PM2518X/01/11

Service Manual

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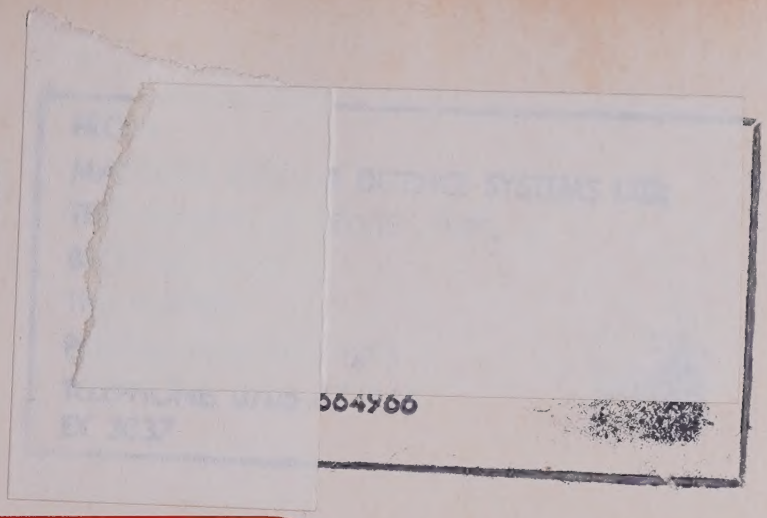

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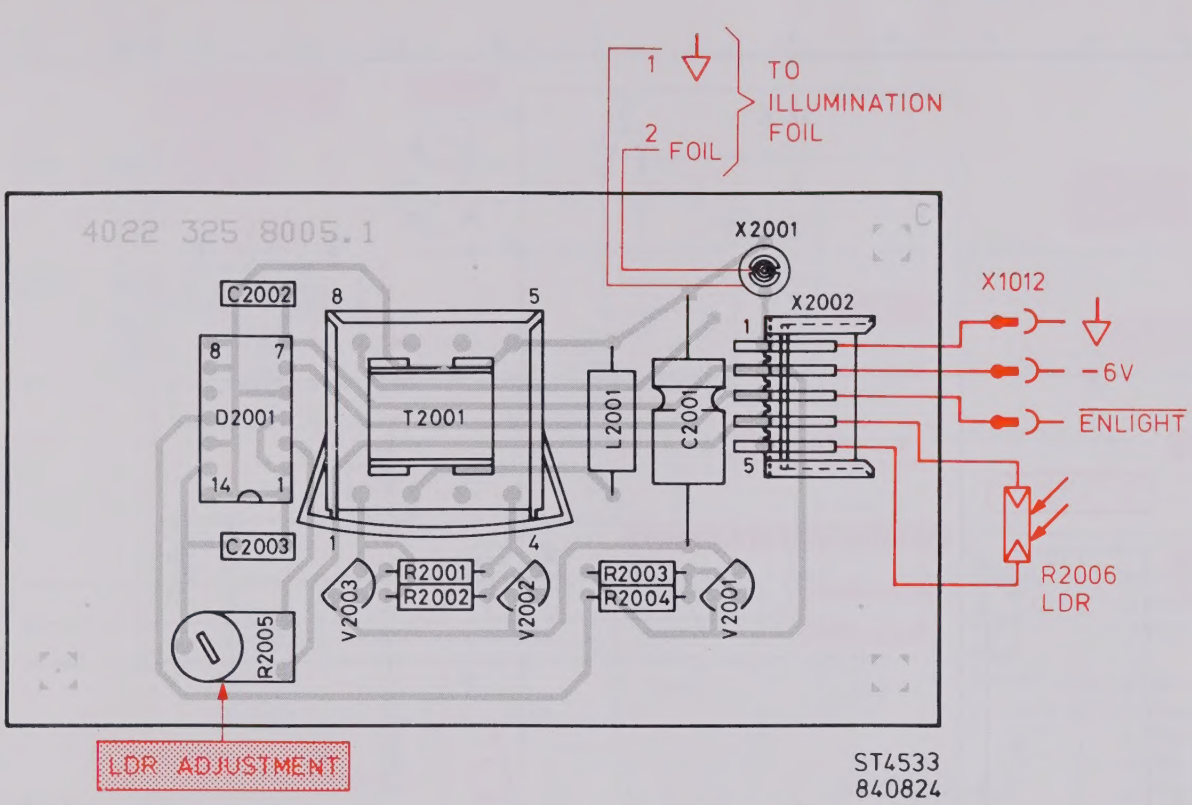

Fig. 7.5. Illumination pc board N2 component side

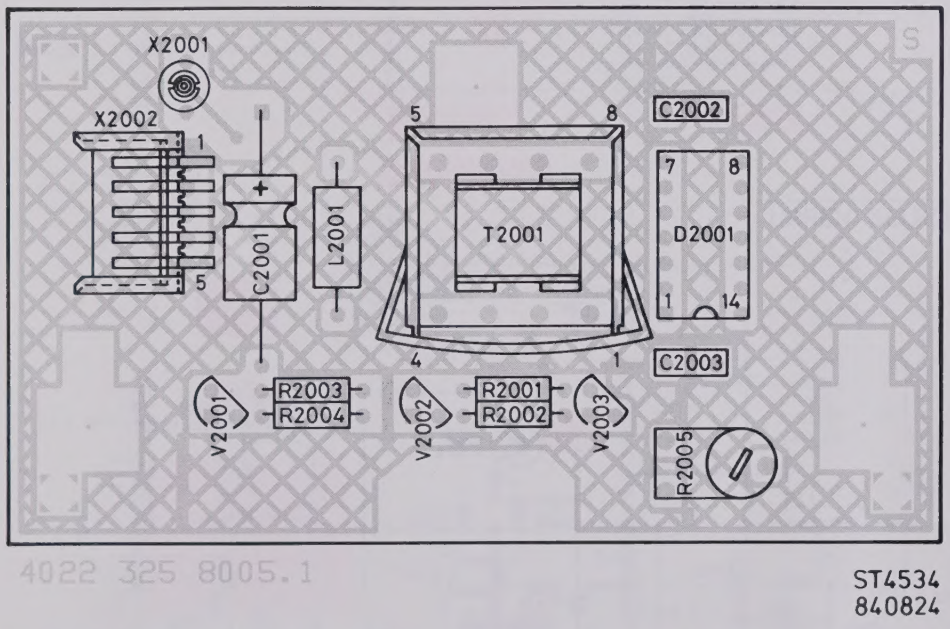

Fig. 7.6. Illumination pc board N2 conductor side

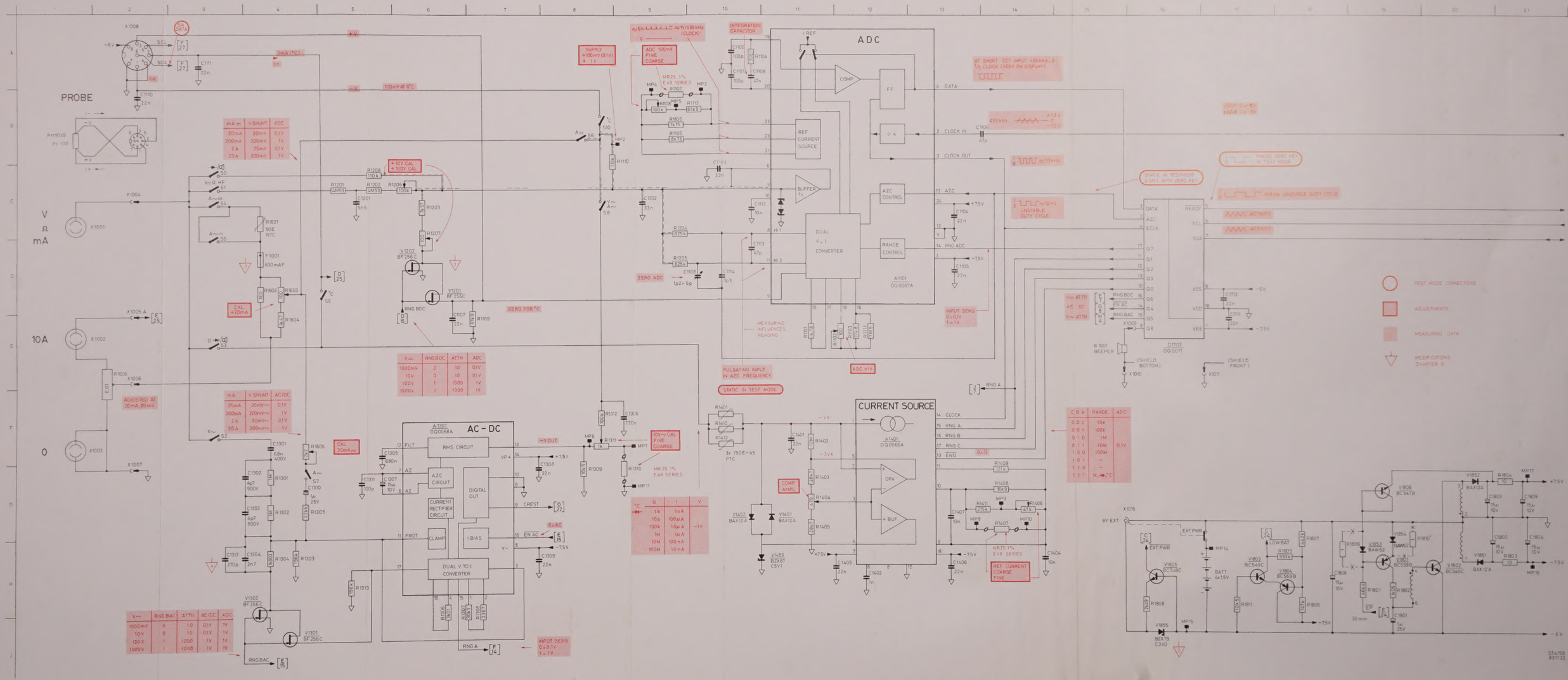

Fig. 7.7. Analog section

2. CIRCUIT DESCRIPTION

2.1. EXPLANATION OF THE BLOCKDIAGRAM

The PM2518X can be sudivided into three parts viz: ANALOG, ADC, DIGITAL

2.1.1. Analog part

The analog part consists of special made integrated circuits and their input circuitry.
viz: —For dc voltage only a dc-attenuator :10, :1000

- For ac voltages a ac-attenuator :10, :1000 and a AC/DC convertor IC OQ0068A. The AC/DC convertor has a programmable input sensitivity of 0.1V. The convertor can be enabled with signal $\overline{enac}$.
- For dc currents two shunts. One for the 20mA and 200mA range, and one for the 2A and 20A range. The 2A/20A range have a combined separate input.
- For ac currents two shunts as for dc currents and a AC/DC convertor as for ac voltages.
- For resistances/diodes/temperature a programmable current source OQ0066A with the different currents for the ranges and the dc-attenuator. The current source can be enabled with signal en $\overline{\Omega}$
- For HF voltages the dc-attenuator. The HF voltage function is the same as the 10Vdc range.

2.1.2. ADC (Analog to Digital Convertor)

The ADC consists of one IC OQ0067A according the DELTA MODULATION principle. It has a dual input, the possibility for AUTO/ZERO compensation and a programmable input sensitivity of 0.1V and 1V.

2.1.3. Digital part

Consists of:
- Special µp with built-in ROM-PCD 8520/002
  Inputs ; Mode switches, Function selector, 10A socket, Crest factor, I^2C BUS.
  Outputs ; I^2C-BUS and enable illumination for /11 only.
- ADC interface OQ0071. This circuit receives data via the I^2C-BUS from the µp and will run independently of the µp. When finished it will produce signal ready for the µp.
  The interface receives its clock indirectly from the µp clock (:4). It supplies range switching information to the analog section, enables signals for the current source and the AC/DC convertor.
  It takes care of conversion of the ADC data signal into I^2C level data for the µp.
- Display interface OQ0070. The interface receives data via the I^2C-BUS from the µp. The LX display itself is a triplex display.

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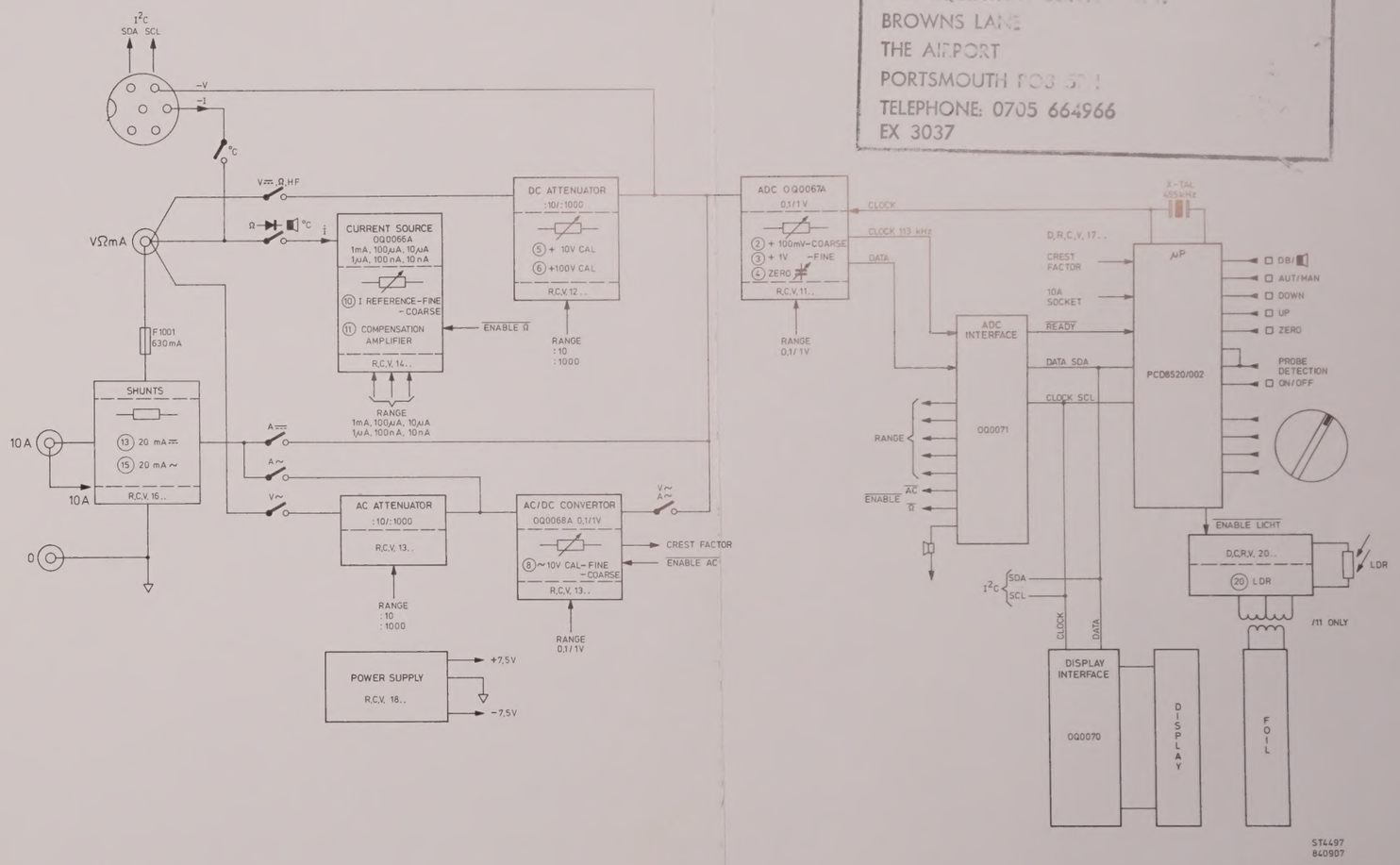

Fig. 2.1. Block diagram PM2518X/01/11

2.2. PRINCIPLE OF OPERATION

2.2.1. DC voltage attenuator

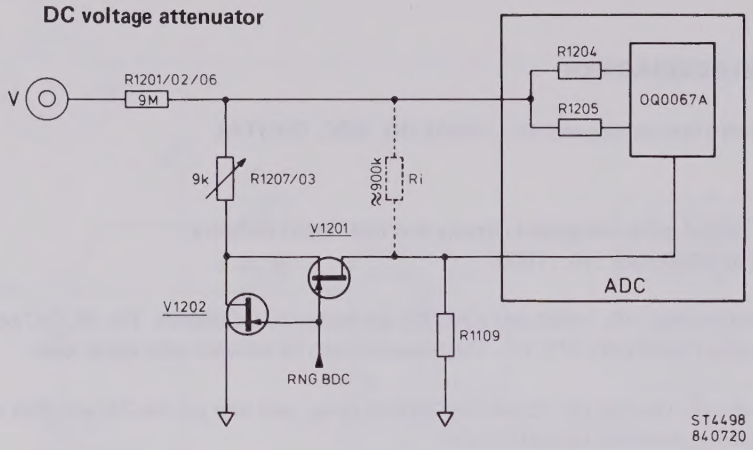

Fig. 2.2. DC voltage attenuator

–Ri ADC is ≈ 900kΩ
–Attenuation 10 or 1000
–R1109 for elimination of Ri of FET's

2.2.2. AC voltage attenuator

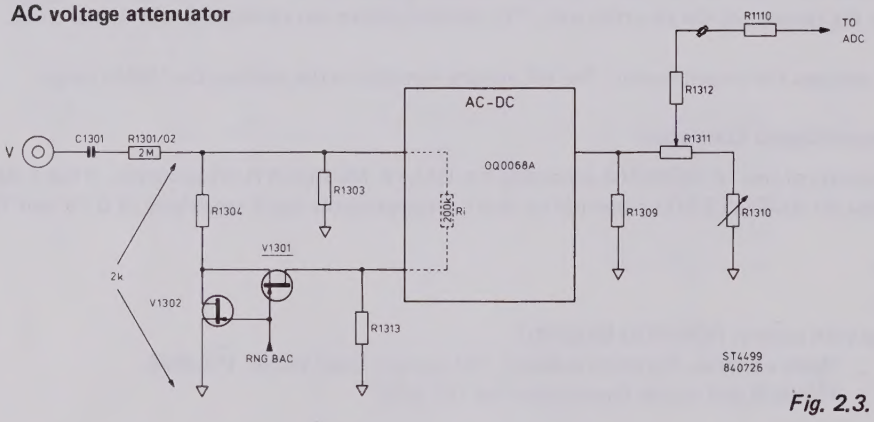

Fig. 2.3. AC voltage attenuator

–Ri AC/DC convertor is ≈ 200k
–Attenuation 10 or 1000

2.2.3. AC/DC shunts

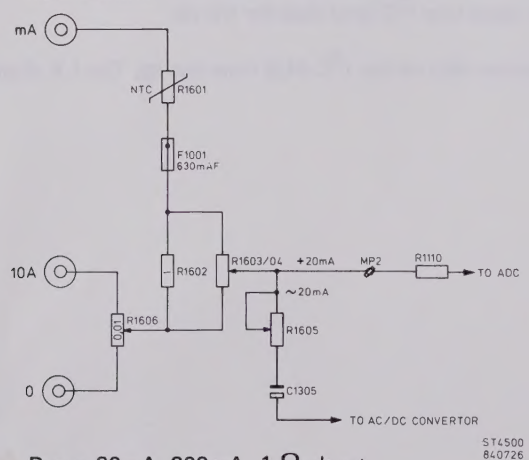

Fig. 2.4. AC/DC shunts

Range 20mA 200mA 1 Ω shunt
Range 2A 20A 0,01 Ω shunt

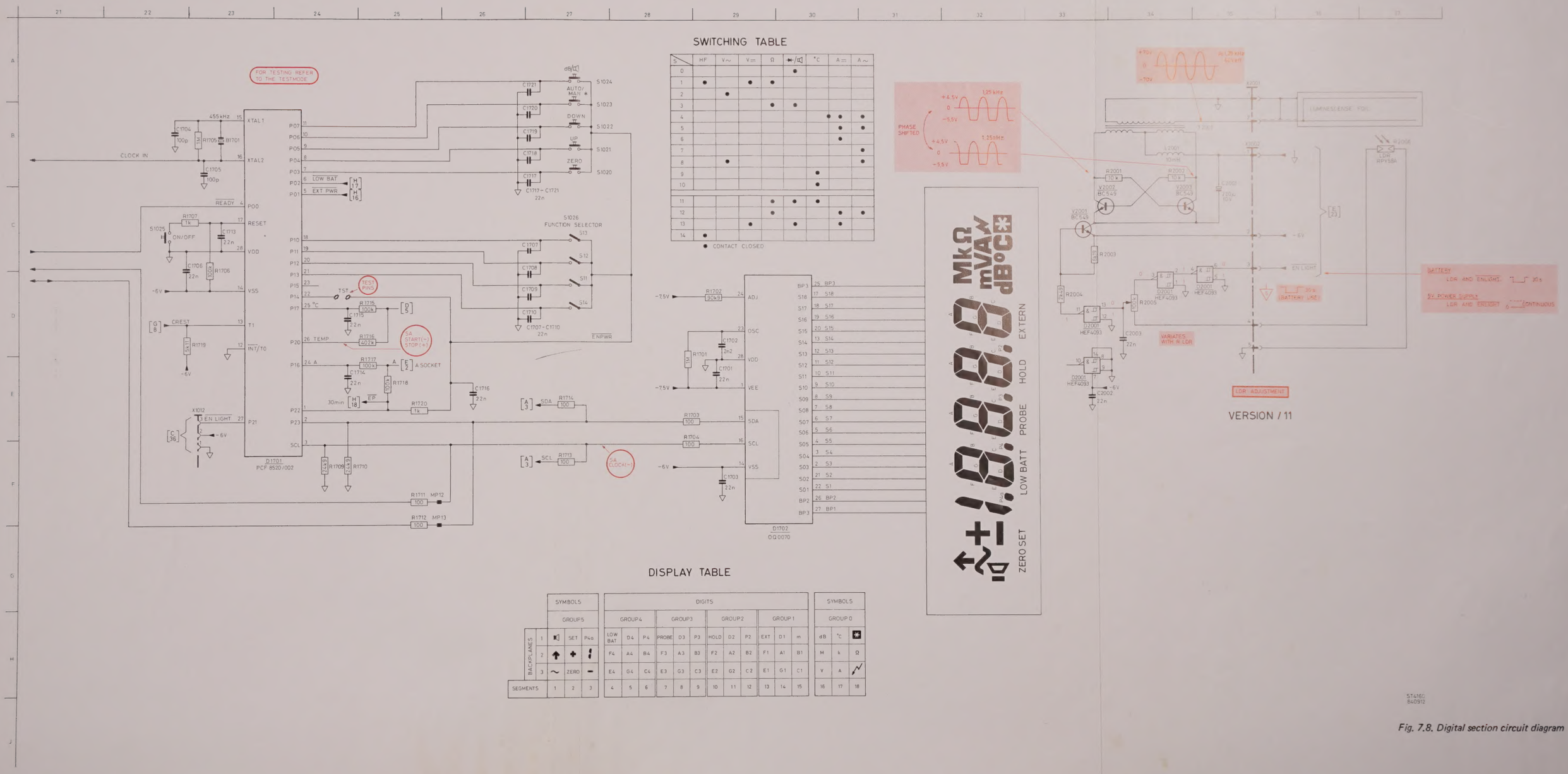

Fig. 7.8. Digital section circuit diagram

7. CIRCUIT DIAGRAMS AND LAY-OUTS

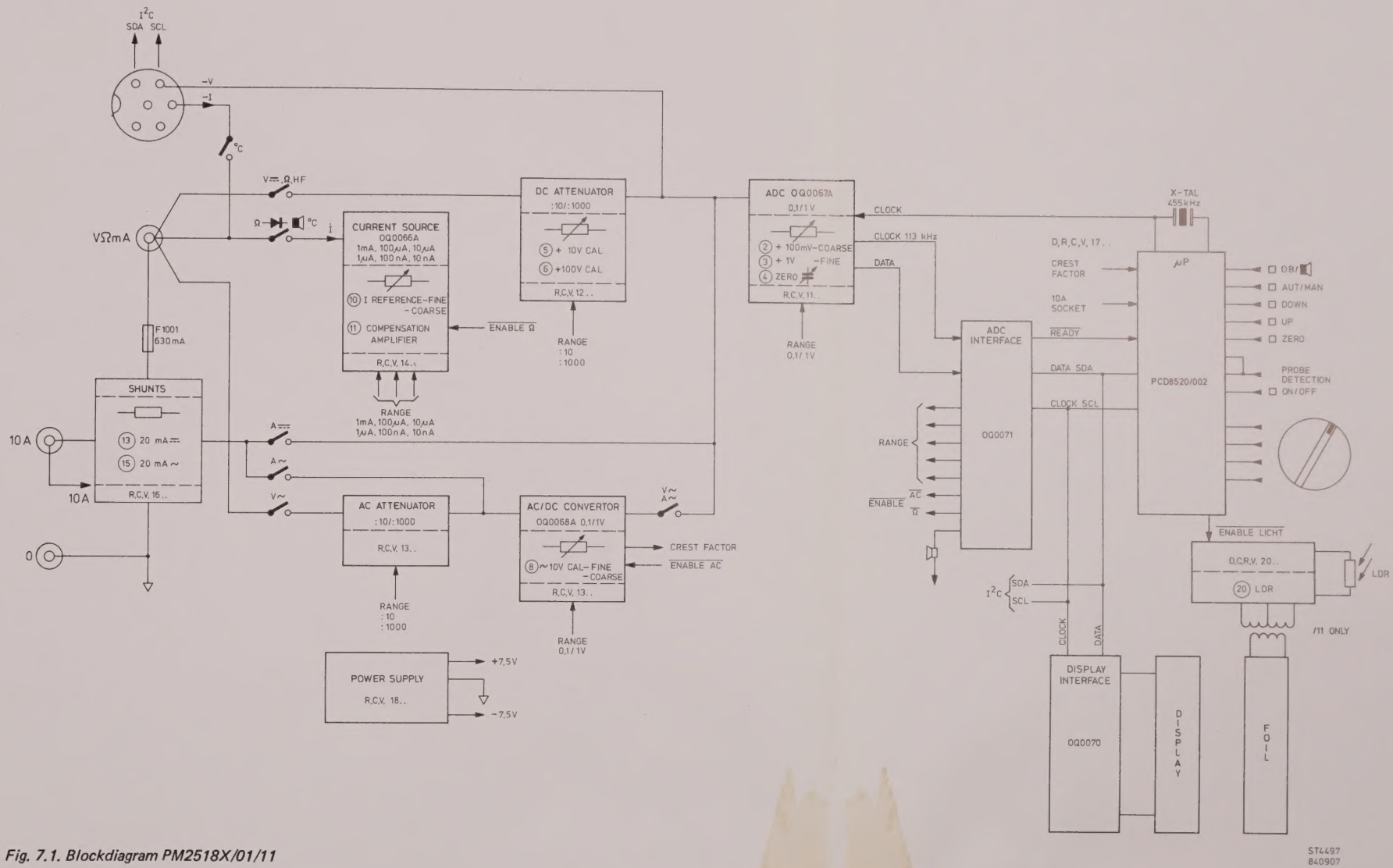

Fig. 7.1. Blockdiagram PM2518X/01/11

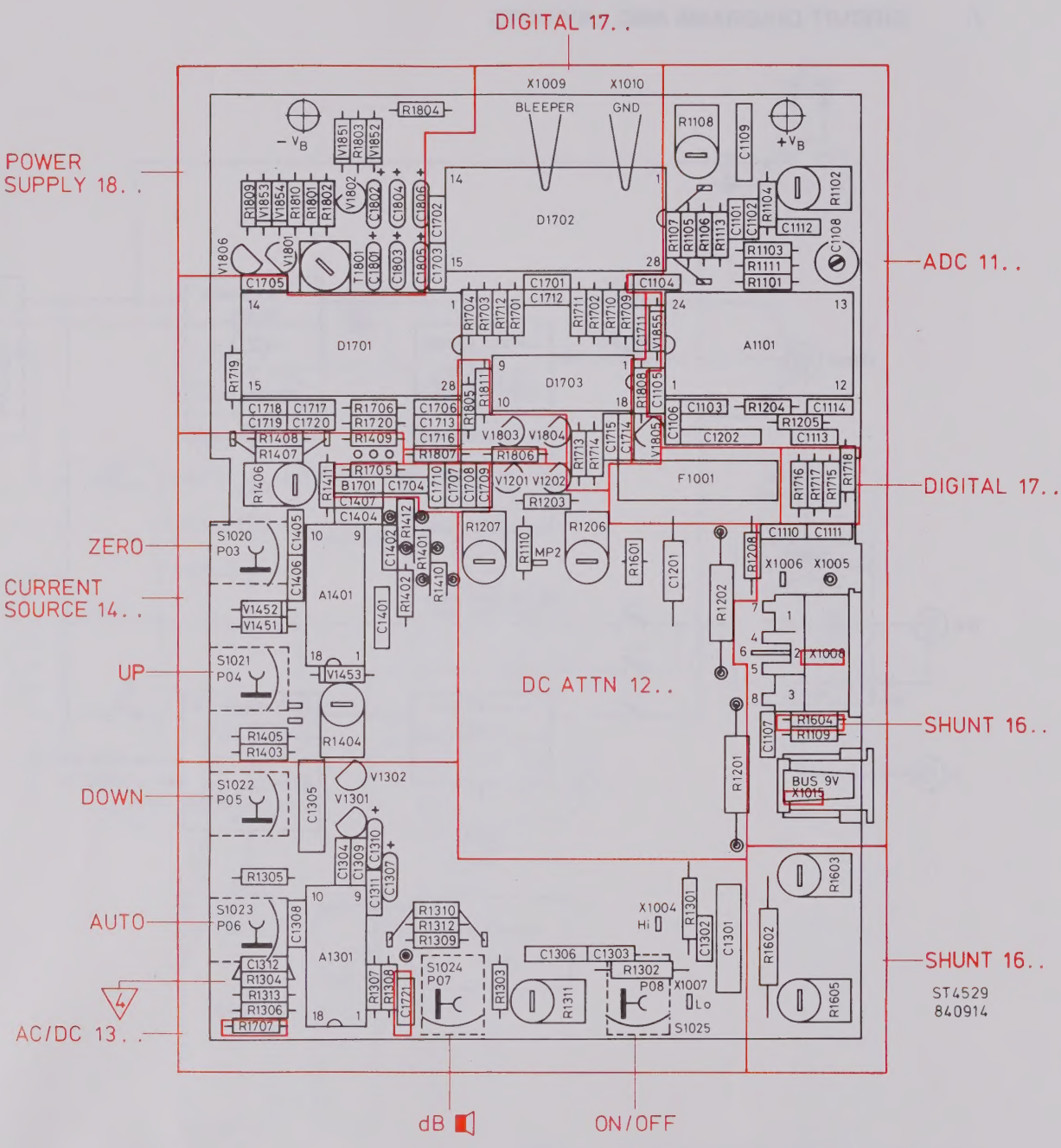

Fig. 7.2. Pc board parts location

Output data examples

	HEADER							BODY													
Char	1	2	3	4	5	6	7	8	9	10	11	12	13	14	15	16	17	18			
Data	V	D	C	sp	Z	sp	sp	+	1	2	3	.	4	5	E	–	3	NL	^	END	
	A	A	C	sp	sp	C	sp	sp	0	1	2	.	4	5	E	–	3	NL	^	END	
	V	A	C	sp	sp	sp	sp	sp	0	0	0	2	.	5	E	–	3	NL	^	END	
	V	A	C	sp	sp	sp	sp	–	0	0	4	9	.	2	sp	d	B	NL	^	END	

Char	ISO char	Explanation
1-3	A-Z or sp	a three character header, indicating the position of the function switch.
4,7	sp	a space for readability of the string
5	Z or sp	Z measurement with relative reference sp measurement without relative reference
6	O, U, C or sp	O Overload in this range (meas. data is 99999) U Underload (meas. data is –99999) (dB only) C crest factor exceded (VAC & AAC) sp no crest factor exceded in VAC or AAC no overload (all functions)
8	+/–, sp	+/– polarity in the functions VDC, DIO, ADC, °C and relative reference mode sp in all other cases
9/14	0/9	0/9 Decimal representation of the measurement data . Floating decimal point
15	E	First letter of the word "EXPONENT"
16	+/–	Polarity of the exponent
17	0, 3, 6	Exponent of the base (–3, 0 + 3, + 6)
18		Record separator with END message The record separator is programmable At power on the default separator is NL (new line)

4.5.4. Application with the PM9181

With the interface it is possible to make a semi-automatic test and calibration set-up as shown in the figure below.

For support of this set-up with: Controller P2000C
Calibrator Fluke 5100B
PM9181
PM2518X/01/11

contact NEDERLANDSE PHILIPS BEDRIJVEN B.V.
Science & Industrial Equipment B.V.
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Tel. 0(internat. –31)5490–18291
Telex 36591 nlxalsu

Service Department.

NOTE: From september 1984 on the PM9181 is commercial deliverable.

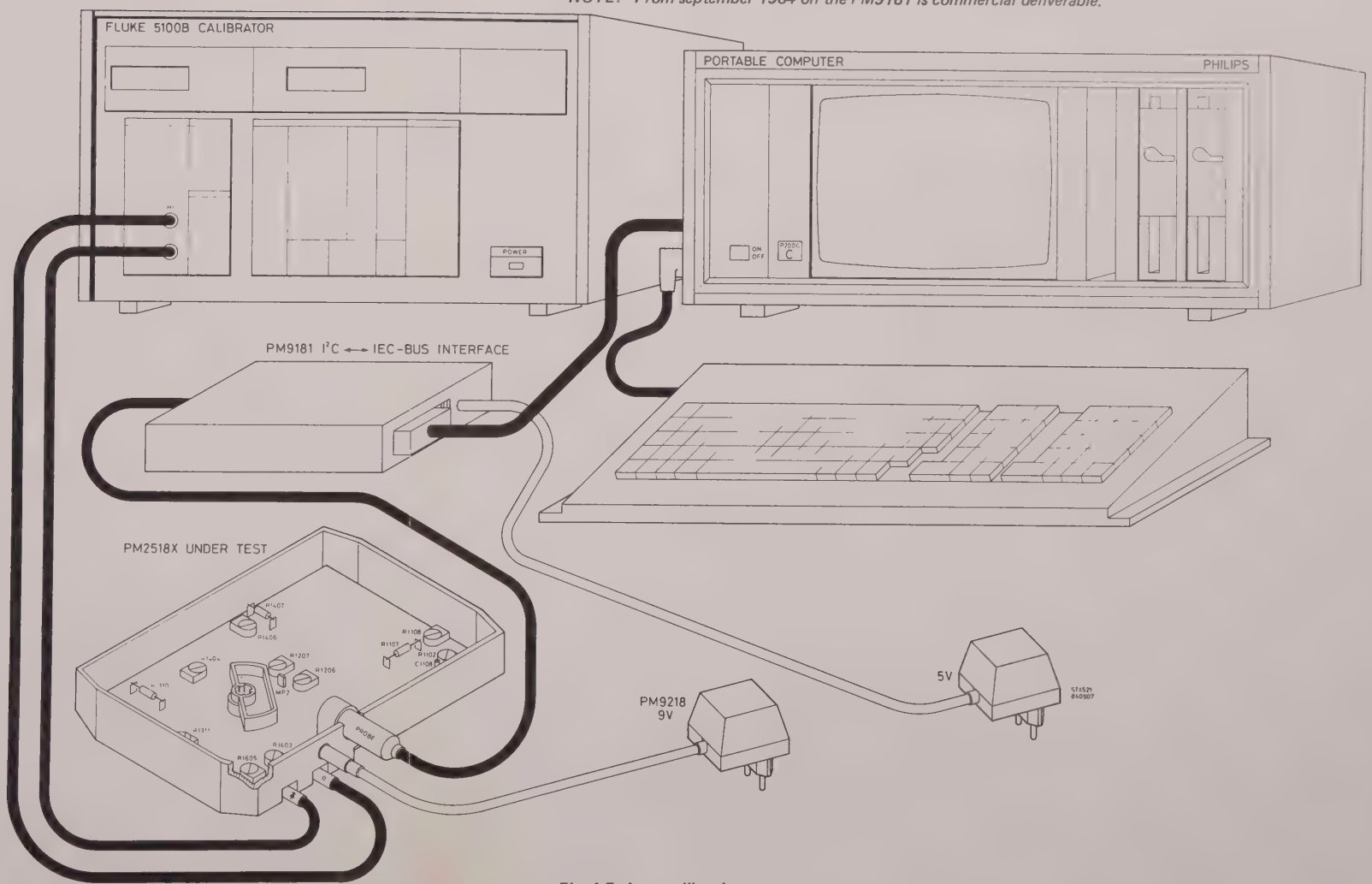

Fig. 4.5. Auto calibration set-up

Multimeter
PM2518X/01/11

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IMPORTANT

In correspondence concerning this instrument, please quote the type number and serial number as given on the type plate.

NOTE: *The design of this instrument is subject to continuous development and improvement. Therefore the instrument may not exactly comply with the information in the manual.*

WICHTIG

Bei Schriftwechsel über dieses Gerät wird gebeten, die genaue Typenbezeichnung und die Gerätenummer anzugeben. Diese befinden sich auf dem Leistungsschild.

BEMERKUNG: *Die Konstruktion und Schaltung dieses Geräts wird ständig weiterentwickelt und verbessert. Deswegen kann dieses Gerät von den in dieser Anleitung stehenden Angaben abweichen.*

IMPORTANT

Dans votre correspondance se rapportant à cet appareil, veuillez indiquer le numéro de type et le numéro de série qui sont marqués sur la plaquette de caractéristiques.

REMARQUES: *Cet appareil est l'objet de développements et améliorations continuels. En conséquence, certains détails mineurs peuvent différer des informations données dans la présente notice d'emploi et d'entretien.*

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1. SPECIFICATION FOR DIGITAL MULTIMETER PM 2518X/01/11

PERFORMANCE CHARACTERISTICS

Properties expressed in numerical values with stated tolerances are quaranteed by **N.V. Philips' Gloeilampenfabrieken.** Specified non-tolerance numerical values indicate those that could be **nominally** expected from the mean of a range of identical instruments.
Terms used in these specifications are based on definitions layed down in IEC 485.

1.1. GENERAL

Manufacturer	Nederlandse Philips bedrijven B.V. S&I
Typenumber	PM 2518X
Designation	Digital multimeter
Measurement functions	V⎓, V~, A ⎓, A ~ , Ω,→▶|, ◧, °C, HF, Zero suppresion, dB

1.2. MEASUREMENT PERFORMANCE

1.2.1. DC voltage measurements

Ranges	1V, 10V, 100V, 1000V
Max. input voltage	1000V
Resolution	100μV in 1V range
Number of representation units	11000
Accuracy	± (0,1% of reading + 0.02% of range)
Temperature coefficient	± 0,15% /°C
Input impedance	1V, 10V range 10 → MΩ ± 1% 100V, 1000V range 9.1 → MΩ ± 1%
Offset current at input	< 20 pA
Series mode rejection ratio (SMRR)	1V, 10V 60dB } for AC signals 100V, 1000V 40dB } of 50 Hz ± 1%
Common mode rejection ratio (CMRR)	100dB for DC signals 80dB for AC signals 50/60 Hz
Max. common mode voltage	400V
Response time	< 1s without ranging < 1.5s with ranging
Zeroing	Automatic
Relative reference setting	ON/RECALL: with pushbutton ZERO OFF: with pushbutton AUTO/MAN
Audible tone	ON/OFF: with pushbutton ◧ Audible tone if display 10.000 ± 4 units
High voltage sign	High voltage sign (⚡) if Vin > 110 V in 1000V range
Maximum voltage	HI and LO 1000Vrms HI and EARTH 1000Vrms LO and EARTH 400Vrms
Max. VHz product of input signal	10^7

1.2.2. AC voltages measurement

Ranges	1V, 10V, 100V, 1000V.
Max. input voltage	600V
Resolution	100μV in 1V range Measured value less than 20 digits is displayed as zero
Number of representation units	11000
Accuracy (valid between 3% and 100% of range)	40 Hz - 1kHz ± (0.5% of reading + 0.1% of range) 1kHz - 10kHz ± (1% of reading + 0.1% of range) 10kHz - 20kHz ± (5% of reading + 0.1% of range)
Temperature coefficient	0.03% /^{o}C
Input impedance	1V, 10V range 2.2 MΩ ± 1% 100V, 1000V range 2 MΩ ± 1%
Common mode rejection ratio (CMRR)	100dB for DC signals 80dB for AC signals 50/60 Hz
Frequency range	40 Hz - 20 kHz
AC detector	True RMS convertor, AC coupled
Crest factor	2 at range end, indication (↑) if crest factor overload
Response time	< 1s without ranging < 2s with ranging
Relative reference setting	ON/RECALL: with pushbutton ZERO OFF: with pushbutton AUTO/MAN
dB measurements	ON/OFF: with pushbutton dB For specification see sub. 1.2.3.
High voltage sign	High voltage sign (↯) if Vin > 110V in 1000V range
Maximum AC voltage	HI and LO 600Vrms HI and EARTH 600Vrms LO and EARTH 400Vrms
Maximum DC voltage	400V
Max. Vhz product of input signal	10^7

1.2.3. dB measurements of AC voltages

Range	–51 . . . + 43.1 dB
Max. input voltage	600V
0 dB resolute reference	1 mW in 600 Ω (0.7746V)
Relative reference setting	ON/RECALL: with pushbutton ZERO OFF: with pushbutton AUTO/MAN
Resolution	0.1 dB for signals > 10mV (–37.7 dB) 1 dB for signals < 10mV Underload (UL) for signals < 2 mV (–51dB)
Number of representation units	999 for signals ⩾ 10mV 99 for signals < 10mV
Accuracy	
signals –20 . . . +43.1 dB	40 Hz . . . 10kHz ± 0.3 dB 10kHz . . . 20kHz ± 1 dB
signals –37.7 . . . –20 dB	40 Hz . . . 10kHz ± 1 dB 10kHz . . . 20kHz ± 4 dB
signals –51 . . . –37.7 dB	40 Hz . . . 10kHz ± 6 dB
Temperature coefficient	0.003 dB/^{o}C
Input impedance	For signals +22.2 dB 2.2 M Ω ± 1% For signals +22.2 dB 2 M Ω ± 1%

Common mode rejection ratio (CMRR)	100 dB for DC signals 80 dB for AC signals
Frequency range	40 Hz . . . 20kHz
AC detector	True RMS convertor, AC coupled
Crest factor	2 at range end, indication (↑) by crest factor overload
Response time	< 2s
High voltage sign	High voltage sign (⚡) if Vin > 110 Vrms in range 1000V
Maximum voltage	HI and LO 600Vrms HI and EARTH 600Vrms LO and EARTH 400Vrms
Max. DC voltage	400V
Max. VHz product of input signal	10^7

1.2.4. Resistance measurements

Ranges	1kΩ, 10kΩ, 100kΩ, 1MΩ, 10MΩ, 100MΩ (manual only)
Resolution	100 mΩ in 1kΩ range
Number of representation units	11000 for all ranges except 100MΩ 1100 for 100MΩ range
Accuracy	1kΩ, 10kΩ, 100kΩ ranges: ± (0.3% of reading + 0,1% of range) 1MΩ, 10MΩ ranges: ± (0,5% of reading ± 0,1% of range) 100MΩ range: ± (5% of reading ± 0.5% of range)
Temperature coefficient	1kΩ, 10kΩ, 100kΩ, 1MΩ ranges: ± 0.02% /°C 10 MΩ range: ± 0,05% /°C 100 MΩ range: ± 0,5 % /°C
Measuring current	1mA, 100μA, 10μA, 1mA, 100nA, 10nA
Max. voltage at open input	3V
Relative reference setting	ON/RECALL: with pushbutton ZERO OFF: with pushbutton AUTO/MAN
Audible tone	ON/OFF with pushbutton Audible tone if display < 100 ± 4 units (all ranges)
Polarity of input terminals	– on HI; + on LO
Response time	< 1s without ranging (except for 100MΩ range) < 3s with ranging 100MΩ range (manual only) < 10s
Protected up to	250 Vrms
Maximum voltage	HI and LO 250Vrms HI and EARTH 400Vrms LO and EARTH 400Vrms

1.2.5. Diode measurement & continuity check

Function selection	Continuity/diode with pushbutton (default funtion: continuity check)
Driving current	1 mA
Range	Diode function 1 V Continuity check 1 kΩ Diode function 100 µV Continuity check 100mΩ
Number of representation units	11.000
Audible tone by continuity check	Audible tone if display < 100 ± 4 digits. (< 10Ω)
Relative reference setting	ON/RECALL with pushbutton ZERO OFF with pushbutton AUTO/MAN
Response time continuity check	< 0.25 sec.
Protected up to	250Vrms
Maximum voltage	HI and LO 250Vrms HI and EARTH 400Vrms LO and EARTH 400Vrms

1.2.6. DC current measurements

Ranges	20mA, 200mA, 2A, 20A
Max. input current in 20A range	10A continue, 20A for 20s
Resolution	10µA in 20mA range
Number of representation units	2200
Accuracy	± (0,5% of reading + 0,1% of range)
Temperature coefficient	± 0,05% /°C
Voltage drop over shunt	20mA, 2A range < 25 mV 200mA, 20A range < 250mV
Response time	< 1s
Protected up to	250Vrms range 20mA 200mA range 2A, 20A not protected
Max. common mode voltage	400V
Relative reference setting	ON/RECALL: with pushbutton ZERO OFF: with pushbutton AUTO/MAN
Maximum voltage	HI and LO 250Vrms HI and EARTH 400Vrms LO and EARTH 400Vrms

1.2.7. AC current measurements

Ranges	20mA, 200mA, 2A, 20A
Maximum input current in 20A range	10A continue, 20A for 20s
Resolution	10μA in 20mA range Measured value less than 20 digits is displayed as zero
Number of representation units	2200
Accuracy (valid between 3% and 100% of range)	± (0,8% of reading + 0,1% of range) at 50Hz input signal
Temperature coefficient	± 0,05% /°C
Voltage drop over shunt	20mA, 2A range < 25mV 200mA, 20A range <250mV
Frequency range	40Hz - 1kHz
AC detector	True RMS converter, AC coupled
Crest factor	9 at range end Indication (↑) if crest factor overload
Response time	< 2s
Protected up to	250Vrms range 20mA, 200mA Range 2A, 20A not protected
Relative reference setting	ON/RECALL: with pushbutton ZERO OFF: with pushbutton AUTO/MAN
Maximum voltage	HI and LO 250Vrms HI and EARTH 400Vrms LO and EARTH 400Vrms

1.2.8. Temperature measurements (with probe PM 9249)

Transducer type	Pt 100
Range	–60 . . +200°C
Resolution	0,1°C
Number of representation units	11000
Accuracy (incl. probe) PM 2518X + PM 9249)	– 20 . . . +100°C ± 1°C – 60 . . . – 20°C + 1 to –2.5°C +100 . . . +200°C + 1 to –5 °C
Permissible voltage at probe tip	60VDC 30VAC
Relative reference setting	ON/RECALL: with pushbutton ZERO OFF: with pushbutton AUTO/MAN

1.2.9. HF voltage measurements (with probe PM 9210)

Range	150mV . . . 10V
Resolution	1 mV
Number of representation units	11000
Accuracy (incl. probe) (PM 2518X + PM 9210)	± 5% 100kHz . . . 6MHz ± 3dB 100kHz . . . 1GHz
Frequency range	100kHz . . . 1GHz
Max. input voltage	30VAC 60VDC
Input capitance	2 pF
Relative reference setting	ON/RECALL: with pushbutton ZERO OFF: with pushbutton AUTO/MAN

1.2.10. dB measurements of HF voltages (with probe PM 9210)

Range	−3.4 . . . +33.9 dB
0 dB absolute reference	1mW in 50Ω (0.224V)
Relative reference setting	ON/RECALL: with pushbutton ZERO OFF: with pushbutton AUTO/MAN
Resolution	0.1 dB for signals ⩾ 100mV 1 dB for signals < 100mV
Number of representation units	999 for signals ⩾ 100mV 99 for signals < 100mV
Accuracy (signals −3.4 . . . +33 dB)	100kHz . . . 6MHz ± 0,6 dB 100kHz . . . 1GHz ± 3 dB
Frequency range	100kHz . . . 1GHz
Max. input voltage	30 VAC 60VDC
Input capacitance	2 pF

1.3. CONVERSION CHARACTERISTICS

Kind of conversion	Linear
Operating pricnciple	Delta modulation
Basic mode of operation	Repetitive triggered
Range setting	Automatic Manual by means of UP/DOWN steps
Polarity setting	Automatic

1.4. VISUAL REPRESENTATION

Range setting	Range up at 2200 ± for (m) A ranges 11000 ± for other ranges Range down at 200 ± 4 for (m) A ranges 1000 ± 4 for other ranges
Output value representation	LCD 100mm, reflective, lighted from front side
Polarity representation	Automatic + and − in LCD
Function representation	With function selector and textplate
Unit representation	Automatic in LCD
Overload representation	LCD indicates OL
Underload representation (dB only)	LCD indicates UL
Decimal point representation	Automatic in LCD
Data hold	By using data hold probe PM 9267
Range hold	By pushbutton AUTO/MAN

1.5. OPERATING CONDITIONS IN ACCORDANCE WITH IEC 359

Climatic conditions	Group I of IEC 359 with extension of the temperature limit
Upper temperature limit	+55°C
Reference temperature	+23 ± 1°C
Rated range of use	−10°C . . . +55°C
Specified range	0°C . . . +45°C
Relative humidity	20 . . . 80% excluding condensation Max. dew point 28°C
Limit range of storage and transport	−40°C . . . +70°C
Mechanical conditions	Group II
From external origin	Electric and electromagnetic fields Magnetic fields Ionizing radiation

1.6. POWER SUPPLY

Batteries	4x type R14 or LR14
External supply	9V with power supply PM 9218A
Battery life time	300 hours with R14 super in case of repeated "ON" switching after AUTO OFF
Operation	ON/OFF with pushbutton ON/OFF.
Battery operation	Automatic OFF switching approx. 45 min. after last switch action or automatic range change.
External supply	ON/OFF with pushbutton ON/OFF

1.7. TIME FUNCTION ADC

Conversation rate	2.5 measurements/s
Range changing time	0.15s
Recovery time from overload in DC voltage ranges	10s

1.8. CALIBRATION

Recalibration interval	1 year

1.9. ACCESSOIRES

Supplied with instrument	Measuring leads PM 9266 (incl. probe) Fuses 1x630mA Fast Operating manual	
Optional	Temperature probe	PM 9249
	EHT probe	PM 9246
	Current transformer	PM 9245
	HF voltage probe	PM 9210
	RF voltage probe	PM 9213
	Shunt	PM 9244
	Data hold probe	PM 9267
	Mains adaptor	PM 9218A
	I^2C IEC BUS interface	PM 9181

1.10. MISCELLANEOUS

Dimensions (lxwxh)	175x120x60
Weight	600 grm.
Cabinet material	A.B.S.

1.11. SAFETY AND ENVIRONMENTAL CONDITIONS

SAFETY

This apparatus has been designed and tested in accordance with Safety Class II requirements of IEC Publication 348 Safety Requirements for Electronic Measuring Apparatus, VDE0411 and has been supplied in a safe condition. This manual contains some informations and warnings which must be followed by the user to ensure operation and to retain the apparatus in a safe condition.

ENVIRONMENTAL CONDITIONS

The environmental data mentioned in this instruction manual are based on the results of the manufacturers checking procedures.
Details on these procedures and failure criteria are supplied on request by the PHILIPS organisation in your country, or by N.V. PHILIPS' GLOEILAMPENFABRIEKEN, SCIENTIFIC & INDUSTRIAL EQUIPMENT DIVISION, EINDHOVEN, THE NETHERLANDS.

1.12. SPECIFICATION FOR DIGITAL MULTIMETER PM2518X/11

1. GENERAL

MANUFACTURER:	Nederlandse Philips Bedrijven M.I.G. S & I
TYPENUMBER:	PM2518X/11
DESIGNATION:	Digital multimeter with illuminated display
MEAS. FUNCTIONS:	$V_{\overline{\cdots}}$, V ~, $A_{\overline{\cdots}}$, A~, Ω, ⊣◀⊢, ◧, °C, HF Zero Suppression, dB, Illumination

2. MEASUREMENT PERFORMANCE

2.1. BASIC INSTRUMENT

For all functions except illumination see: specification of PM2518X/01

2.2. ILLUMINATION

2.2.1. LIGHTING DEVICE

Illumination type:	Electro luminescence foil
Light colour	green
Operation life (–50%)	> 10.000 hrs.

2.2.2. CONVERTER ELECTRONICS

Light switch ON/OFF level	adjustable
Converter frequency	typ. 1.5 kHz
Converter sec. voltage	typ. 60V
Time out time	app. 30s

2.2.3. SWITCH FUNCTION:

Light ON: IF: instrument is switching on
AND: ambient light < "ON leveL"
AND: "action" has occured during last 30s

Light OFF: IF: ambient light > "OFF level"
OR: no "action" has occured during 30s
AND: instrument is NOT on extern power.
OR: instrument is switched OFF
("action" = any switching or autoranging).

2.2.4. POWER

Power consumption	< 150 mW at Vbatt. = 6V
(excl. instrument)	< 100 mW at Vbatt. = 5V

3. FOR ALL OTHER SPECIFICATIONS POINTS: refer to PM2518X/01

2.2.4. Current source

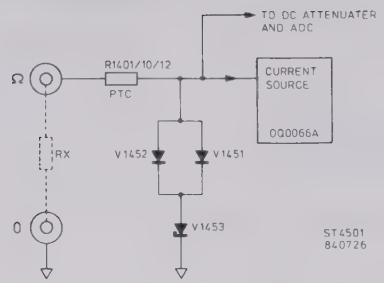
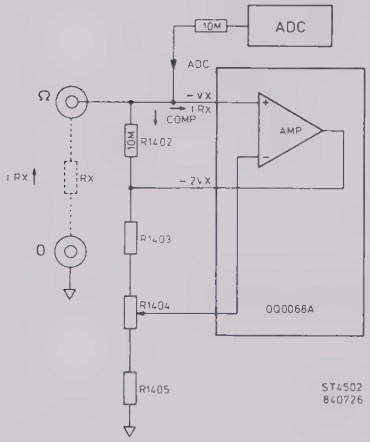


Fig. 2.5. Current source

Compensation of ADC leakage current (I ADC)



I comp = I ADC

Fig. 2.6. I ADC compensation

– Compensation of safety diode leakage current. (I leak)

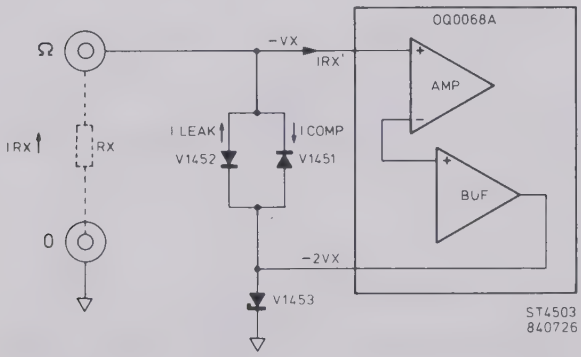


Fig. 2.7. I diode compensation

2.2.5. Power supply

- 9V extern is decreased by diode V1855 and supplied to the switched power supply resulting in + and –7.5V.
- Signal $\overline{EP}$ (enable power) switches of the power supply. $\overline{EP}$ is generated by the μp after 30 minutes if no change of range or function has been made.
- Signal $\overline{EXT\ PWR}$ (external power) indicates the use of an external supply to the μp. Signal $\overline{EP}$ stays true.
- Signal $\overline{LOW\ BATT}$ indicates low battery voltage ($<$ 3.8V) to the μp. The result is LOW BATT on the display.

2.3. SPECIFICATIONS OF SPECIAL IC's

2.3.1. Micro computer PCD 8520/002

SINGLE-CHIP 8-BIT MICROCOMPUTER

DESCRIPTION

The MAB8400 family of single-chip 8-bit microcomputers are fabricated in N-MOS

The family consists of 4 devices:

- **MAB 8400**: capacity of 128 RAM bytes ('Piggy-back version').
- **MAB 8410**: 1K ROM/ 64 RAM bytes,
- **MAB 8420**: 2K ROM/ 64 RAM bytes, *)
- **MAB 8440**: 4K ROM/128 RAM bytes.

*) MAB 8421: same as MAB 8420,
but Port 1: $V_{0L} \leqslant$ at I_{0L} = max. 10 mA

***) PCD 8520 CMOS Version of MAB 8420 2kROM/96 RAM BYTES**

Each type has 20-quasi-bidirectional I/O port lines, one serial I/O line, one single level vectored interrupt, and an 8-bit timer/event counter and an on-board clock oscillator and clock circuits.

This microcomputer family is designed to be an efficient controller as well as an arithmetic processor. The instruction set is based on that of the MAB8048. The microcomputers have extensive bit handling ability and facilities for both binary and BCD arithmetic.

FEATURES

- 8-bit CPU, ROM, RAM, I/O in a single 28-lead DIL package
- 1K, 2K or 4K ROM bytes
- 64, 64 or 128 RAM bytes
- 20 quasi-bidirectional I/O port lines
- Two test inputs: one of which can be used to detect zero voltage cross-over, the other is also the external interrupt input
- Single-level vectored interrupts: external, timer/ event counter, serial I/O
- Serial I/O which can be used in bus systems with more than one master (serial I/O data via an existing port line and clock via dedicated line)
- 8-bit programmable timer/ event counter
- Internal oscillator, clock driver
- Over 80 instructions (based on MAB8048)
- All instructions 1 or 2 cycles
- Single 5V supply (± 10%)
- Operating temperature range: 0 to + 70°C (MAB8400 family), or –40 to + 85°C (MAF8400 family)

PIN DESIGNATION

designation	pin no.	function
V_{SS}	14	**Ground**
V_{CC}	28	**Power supply**, + 5 V (PCD 8520/002 + 6 V)
P00-P07	4-11	**Port 0.** 8-bit quasi-bidirectional I/O port.
P10-P17	18-25	**Port 1.** 8-bit quasi-bidirectional I/O port.
P20-P23	26,27,1,2	**Port 2.** 4-bit quasi-bidirectional I/O port; P23 is the serial data input/output in serial I/O mode.
SCLK	3	Bidirectional clock for serial I/O.
$\overline{INT}$/ T0	12	External interrupt input (sensitive to negative-going edge); testable using the JT0, JNT0 instructions.
T1	13	Input pin testable using the JT1, JNT1 instructions. Can be designated the event counter input, using the STRT CNT instruction. Also allows zero cross-over sensing of moving a.c. inputs.
RESER	17	Input, used to initialize the processor (active HIGH).
XTAL 1	15	Connection to timing component (crystal) which determines the frequency of the internal oscillator. Also the input for an external clock source.
XTAL 2	16	Connection of the other side of timing component.

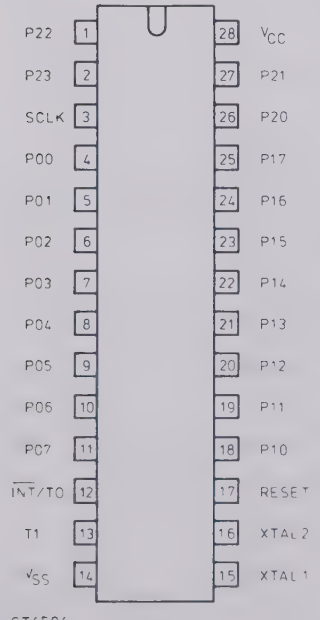


Fig. 2.8. Pinning diagram PCD8520/002

2.3.2. OQ0066A programmable current source

GENERAL DESCRIPTION

The OQ066 is a programmable current source delivering 7 currents in the 10 nA to 10 mA range in decade steps. The output current is controlled by 3 digital range inputs. The principle is based on multiplication c.g. division of a reference current by means of current mirrors with dynamic element matching.
The reference current of 10 microA is derived from a precision current source with adjustable output current and temperature compensation.

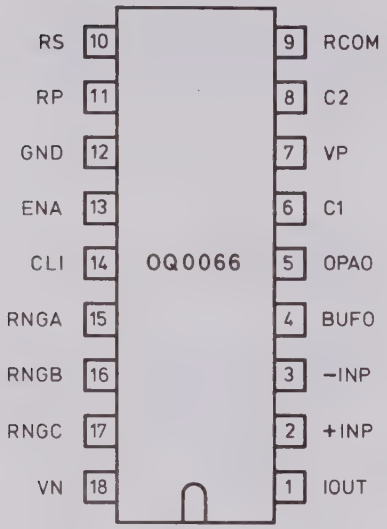


Fig. 2.9. Pinning OQ0066

PIN DESCRIPTION:

1. IOUT Current output
2. +INP Op-Amp non inv. input
3. −INP Op-Amp inv. input
4. BUFO Buffer output
5. OPAO Op-Amp output
6. C1 Op-Amp comp. capacitor
7. VP Positive supply
8. C2 Mille comp. capacitor
9. COM Reference common
10. RS Ref. serial resistor
11. RP Ref. parallel resistor
12. GND Ground
13. ENA Enable input (low active)
14. CLI Clock input
15. RNGA Range A input
16. RNGB Range B input
17. RNGC Range C input
18. VN Negative supply

DIGITAL INPUT CODES

RNG	RNGB	RNGA	Factor	Output (Iref=10μA)
1	1	0	x 1000	10 mA
1	1	1	x 100	1 mA
0	0	0	x 10	100 μA
0	0	1	x 1	10 μA
0	1	0	x 0.1	1 μA
0	1	1	x 0.01	100 n A
1	0	0	x 0.001	10 n A
1	0	1	x t.b.f.	

2.3.3. OQ0067A BI-FET input ADC

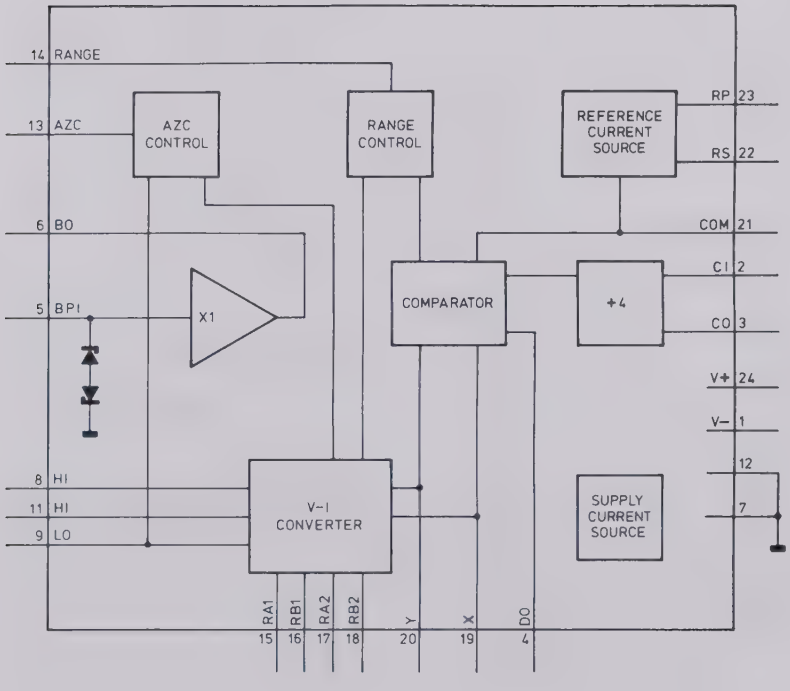


Fig. 2.10. Block diagram OQ0067A

DESCRIPTION

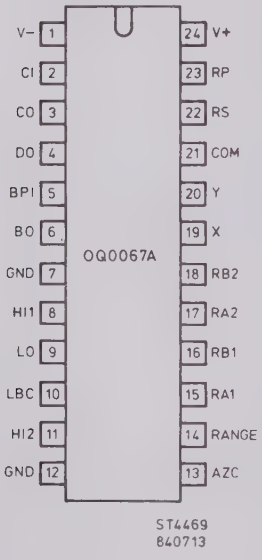
The OQ0067A is a ADC according the Delta Modulator principle. It contains all the parts for a ADC. The output signal is a synchronus datasignal, which can be clocked in a microprocessor with a present clock. The display result is:

$$Disp = \frac{N \times Vin}{\frac{Iref \times Rconv}{2}}$$

N= the number of clockperiods during a measurement. The formule shows that the result will be more accurate with more clockperiods. This can be achieved with a longer measuring period or more clockpulses. To prevent offset voltages a AZC (auto zero compensation) input is available.

Every measuring period consists of two AZC periods. During the firs AZC period the AZC input is logic low and the μp counts the logic value of the datasignal on every edge of the clock. In the second AZC period the datasignal is inverted by the μp. The μp subtracts the logic value of the datasignal on every clock edge. At the same time the inputs of the ADC are interchanged. By this the input offset-voltage is eliminated. Via the range input a selection can be made between the two conversion resistors (input sensitivity 0.1V/1V).

PINNING & PIN FUNCTIONS



PIN NUMBER	NAME	DESCRIPTION
1	V –	Most negative supply & substrate
2	CI	Clock input
3	CO	ADC clock output
4	DO	ADC data output
5	BPI	Buffer & protection input
6	BO	Buffer output
8, 11	HI 1, 2	ADC HI inputs
9	LO	ADC LO input
10	LBC	Low buffer capacitor
7, 12	GND	Digital ground
13	AZC	AZC input
14	RANGE	Range input
15, 17	RA1, 2	Range resistor A
16, 18	RB1, 2	Range resistor B
19, 20	X, Y	Integrator capacitor
21	COM	Common point for current source resistor
22	RS	Series resistor (Current source)
23	RP	Parralel resistor (Current source)
24	V^+	Most positive supply

NOTE: pin numbers 7 and 12 are not connected together internally

Fig. 2.11. Pinning OQ0067A

2.3.4. OQ0068A AC/DC convertor (RMS)

GENERAL DESCRIPTION

The OQ0068 is an integrated AC voltage to DC current converter for use in measuring equipment. The output current is proportional to the RMS value of the input voltage.
Special features are:

- Enable input for power-down mode
- Range input for selection of 2 resistor programmed ranges
- Crest Factor or Zero Crossing output selection
- Low leakage input clamp
- Automatic offset compensation

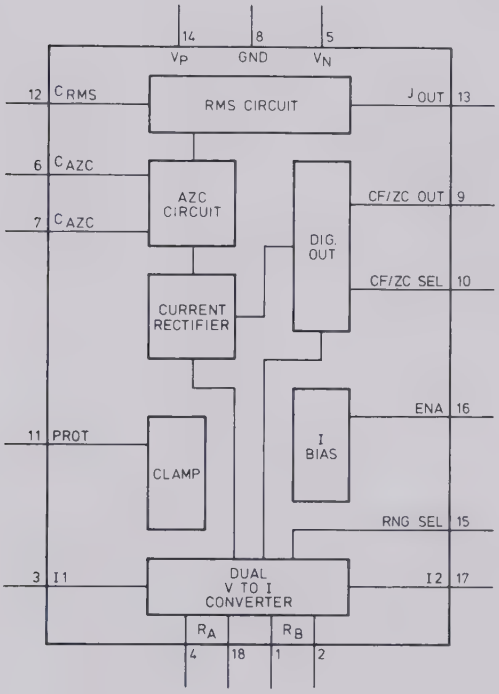


Fig. 2.12. Blockdiagram OQ0068A

OPERATION MODES

ENA	SEL	CF/ZC	SEL RNG	FUNCTION
1		X	X	Power down mode
0		1	0	Low range measurement mode
0		1	1	High range measurement mode
0		0	0	Low range Counter mode
0		0	1	High range counter mode

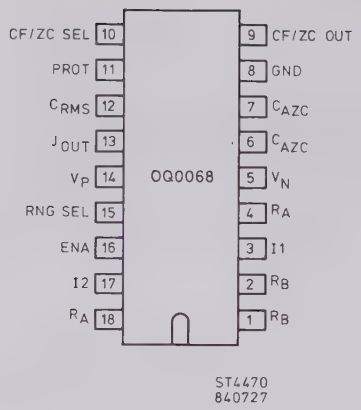


Fig. 2.13. Pinning OQ0068A

PIN DESCRIPTION

1 RB range resistor B
2 RB Range resistor B
3 I1 Input 1
4 RA Range resistor A
5 VN Negative supply
6 CAZ Autozero capacitor
7 CAZ Autozero capacitor
8 GND Ground
9 CF/ZC OUT Digital output
10 CF/ZC SEL Digital output select
11 PROT Input protection clamp
12 CRMS Integrating capacitor
13 IOUT Current output
14 VP Positive supply
15 RNG SEL Range selection
16 ENA Enable input
17 I2 Input 2
18 RA Range resistor A

2.3.5. OQ0070 Triplex LCD driver

GENERAL DESCRIPTION

The OQ0070 is a single chip sillicongate C-MOS circuit, designed to drive a liquid Cristal Display (LCD) with up to 54 segments in a triplex manner. Reference voltages are internally generated with temperature compensation.
A 2-line I^2C bus structure enables serial data transfer with microprocessors. All inputs are C-MOS compatible.

NAME	PIN NUMBER	DESCRIPTION
SO1-S18	2-13 17-22	Driver outputs
BP1-BP3	25, 26, 27	Back planes
REF ADJ.	24	Voltage reference adjustment
SDA	15	Serial data (I^2C)
SCL	16	Serial clock (I^2C)
Vee	1	Negative supply voltage
Vdd	28	Ground
Vss	14	Positive supply voltage

DATA

Scan matrix:

BP1	D50	D53	D56		D00	D03	D06
BP2	D51	D54	D57		D01	D04	D07
BP3	D52	D55	D58		D02	D05	D08
	S01	S02	S03		S016	S017	S018

digit D5 ---- DN -------- D0

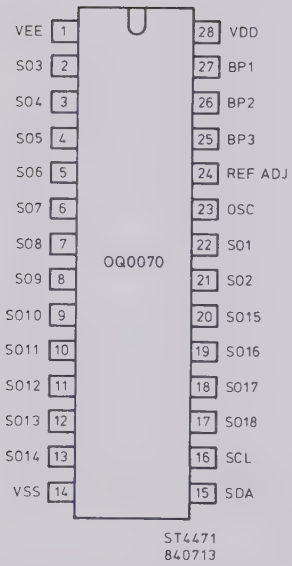


Fig. 2.14. Pinning OQ0070

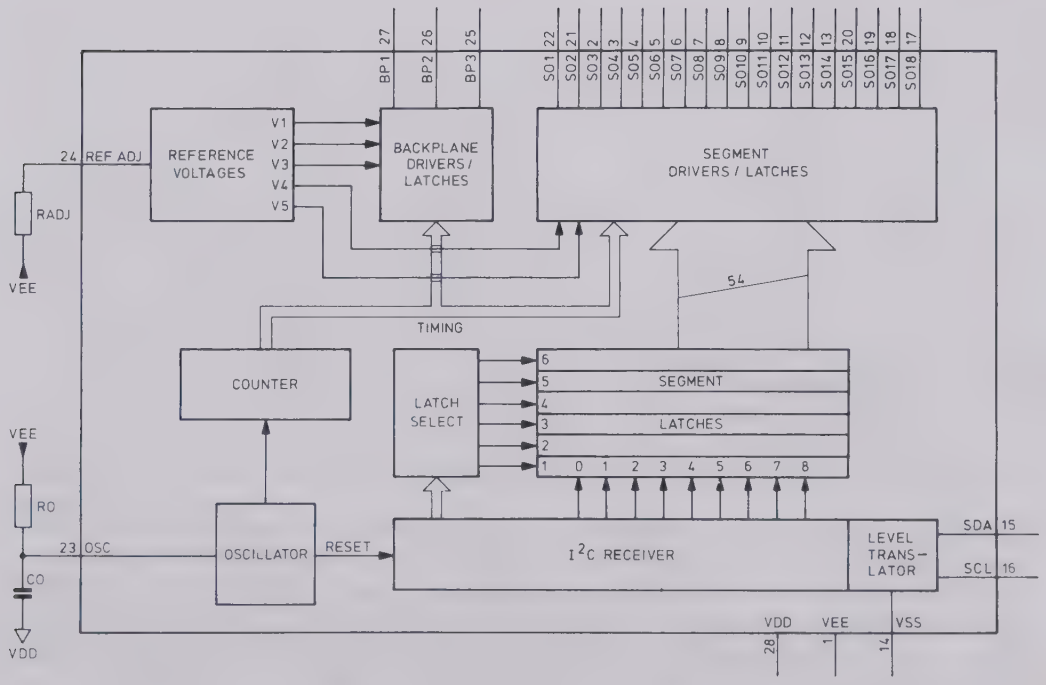


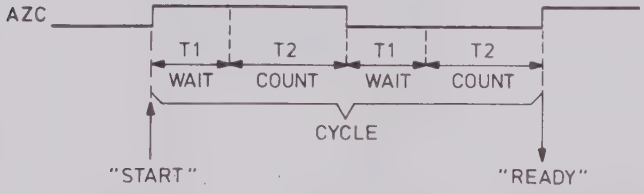
Fig. 2.15. Blockdiagram OQ0070

2.3.6. OQ0071 ADC interface

General

This device is designed as an ADC-interface with I^2C compatible serial data transfer. It contains two 16-bit (serial-in/parallel-out) shift registers, a 16 bit TIMER which can be parallel loaded from one of the two shift registers, a 16-bit serial-in/serial-out synchronic data counter, and a 7-bit presetable counter with an 8-bit serial-in/parallel-out register, in series with an 8-bit serial-in/parallel-out output-driver.

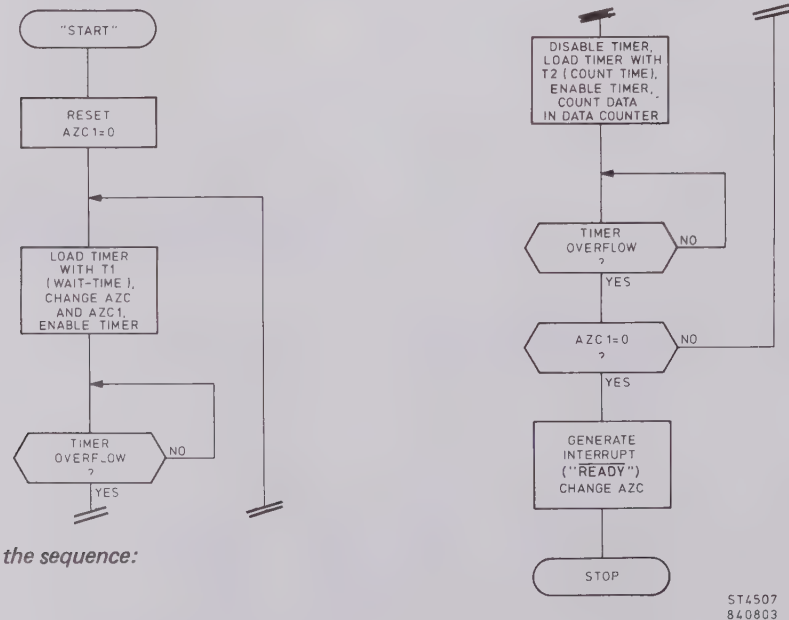
The main purpose of the device is to count the number of clock-pulses within a given time slot (T2; the "measuring time") in which the "DATA" input is opposite to the AZC output, plus the number of clock-pulses in another time slot (T2) in which the AZC-signal has been inverted. This time slot T2 is preceded by a waiting time (T1). The figure below explaines this sequence:



ST4408
840720

At the end of this cycle the device generates an ready signal ($\overline{\text{READY}}$).
The sequence is started by the "STRT" command from the I^2C-interface and is controlled by the "sequence controller".

REMARK: The organisation should be such that when "DATA" is continuous "high" and the number in T_2 is N, that at the end of the count time, the contents of the counter is also N.



ST4507
840803

Flowchart of the sequence:

Besides this function, there is an independent 7-bit counter and 8-bit Output-driver. The 7-bit counter can be enabled or disabled, and is presetable with the 7 least significant bits of an 8-bits shift register.
The carry-signal from this counter loads the counter with the programmable preset and is devided by two to give the symmetrical signal QB. If this counter is disabled, QB is floating; if it is enabled, and the most significant bit of the 8-bit shift register is low, then the output QB is low, while if this bit is high, the output has a frequency of $f_{QB} = f_{ECLK}/2*$ (preset + 2). In which preset is the value of the seven preset bits.
If this counter is preset with all high's, the QB output will be kept high.

The 8-bit counter preset register, and the 8-bit Output shift registers are serialy coupled, to have a 16-bit data-transfer on the SDA-bus. But if the bleeper is enabled, a data transfer through the 8-bit counter-preset-register should **not** be possible.
At the end of the 16-bit data transfer, the data in the 8-bit output shift register should be latched in the 8-output-drivers to update Q0 to Q7.
A logic **zero** in the shift register produces a logic **one** on the Q outputs.

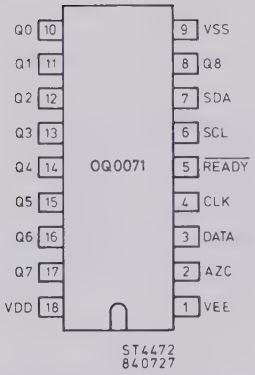


Fig. 2.16. OQ0071 Pinning

Pin no.	Name	Description
1	Vee	Negative supply voltage
2	AZC	Auto zero control output
3	DATA	Data signal input
4	ECL	Enable clock input
5	$\overline{\text{READY}}$	READY output
6	SCL	Serial clock (I^2C)
7	SDA	Serial data (I^2C)
9	Vss	Positive supply voltage
8, 10-17	Q0-8	Outputs
18	Vdd	Ground

2.4. I^2C BUS

The I^2C bus differs considerably from the conventional bus structures in that data-transfer is effected in a bit-serial, rather than in byte-parallel format.
In a conventional microcomputer such as the 8048 for instance, 12 address, 8 data and 4 control lines are necessary for parallel data transfer. The I^2C 8440 microcomputer, on the other hand requires only 2 lines to transfer serially the same amount of data. Chips used for ADC, RAM and LCD drivers are I^2C compatible and use also the same two lines.
These two lines are respectively the SDL (serial data line) and SCL (serial clock line), the function of which is to synchronise data-transfer between the appropriate I^2C devices.

Almost any number of devices can be connected to the I^2C bus. Each device is allocated its own specific 7-bit address which, enables any two of these devices to communicate with each other upon receipt of a message prefixed with the appropriate 7-bit address.
This specific 7-bit address usually comprises a fixed address part (4 bits), a user definable part (3 bits).
The latter being assignable by tying "Define Address" pins to high or low levels.
Address recognition is effected in the I^2C interface hardware of each device, and this eliminates the need for decoding logic. The use of an automatic-invoked arbitration procedure, which prevents two or more devices from transmitting simultaneously, makes I^2C technology eminently suitable for multiprocessor system.

For further information about I^2C see: Philips Data Handbook: Integrated circuits for digital systems in radio, audio and video equipment.

3. ACCESS

WARNING: **The opening of covers or removal of parts, except those to which access can be gained by hand is likely to expose live parts, and accessible terminals may also be live.**

The instrument shall be disconnected from all voltage sources before any replacement or maintenance and repair during which the instrument will be opened.

If afterwards, any adjustment, maintenance or repair of the opened instrument under voltage condition is inevitable, it shall be carried out only by a skilled person who is aware of the hazard involved.

Bear in mind that capacitors inside the instrument may still be charged even if the instrument is separated from all voltage sources.

3.1. DISMANTLING THE PM2518X/01/11

- Remove the battery cover with a screwdriver.
- Lift out the batteries.
- Bend out the two hooks (Fig. 3.1.) and pull the bottom cover from the topcover (Fig. 3.2.).
- For power supply a 9 V external supply PM9218 or an interconnection between the battery hooks and the pc board should be used.
- The PM2518X without bottom cover can easily be adjusted now.

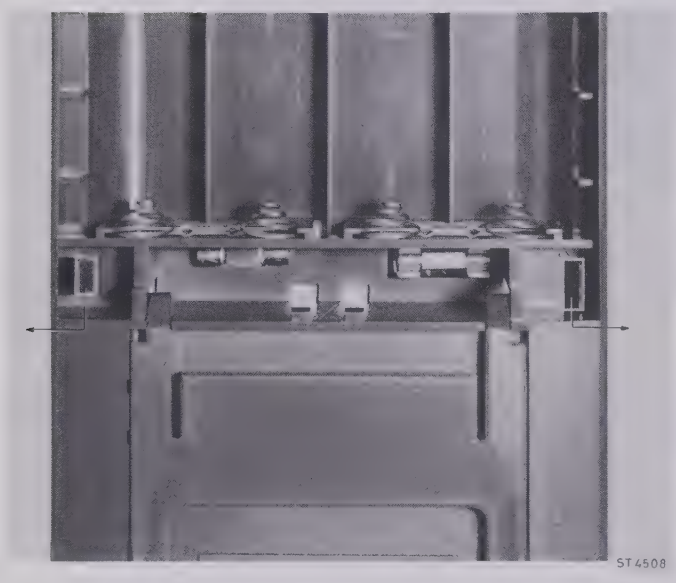


Fig. 3.1. Bottom cover

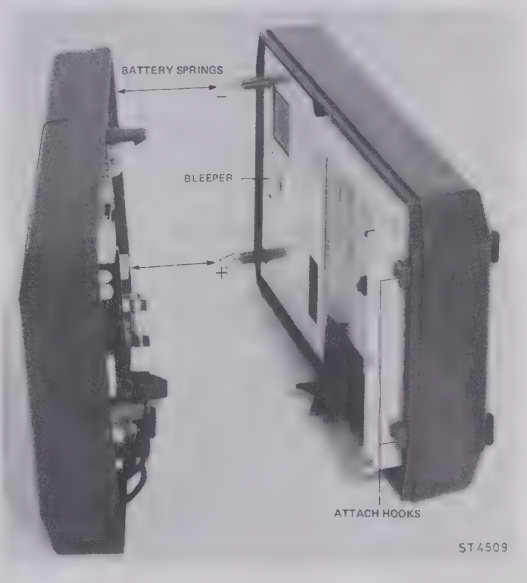


Fig. 3.2. Opening the instrument

3.2. REPLACING PARTS

3.2.1. Parts on the pc board /01/11.

- Dismantle the PM2518X (refer to 3.1.).
- Remove the input socket wiring from the pc board.

NOTE: The connections are a very tight fit. Be careful when unplugging to avoid the printpens be pulled out of the board.

- Lift the pc board out of the topcover by pulling at the black part of the function selector (Fig. 3.3.).

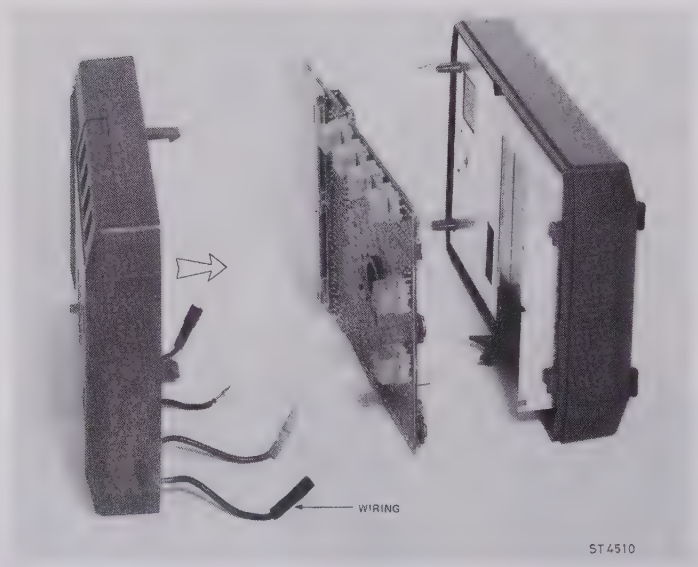


Fig. 3.3. Disassembling the pc board

3.2.2. Function selector on the pc board

- Dismantle the PM2518X (refer to 3.1.).
- Lift the pc board out of the topcover (refer to 3.2.1.).
- The function selector consists of a ring and the slide rotor.
- Push rotor out of the ring of the conductor side of the pc board with a screw driver or a DIN-plug. (Fig. 3.4.)

NOTE: The function selector knob and rotor are keyed.

3.2.3. LX-display /01/11, window and interconnection rubber

- Dismantle the PM2518X (refer to 3.1.).
- Lift the pc board out of the topcover (refer to 3.2.1.).
- Push the LX attach lip out of the attach hole at the component side of the pc board with a pair of tweezers (Fig. 3.4.).
- Lift the LX-display assembly from the pc board.

/01 only

- The assembly consists of three parts (Fig. 3.5.). All three parts can be replaced separately.

/11 only

- The assembly consists of four parts (Fig. 3.6.).
  Only one ordering number for the complete assembly is available (without wiring and LDR).
- On the LX window the LDR holder is mounted. Fig. 3.6. explains how it should be replaced.

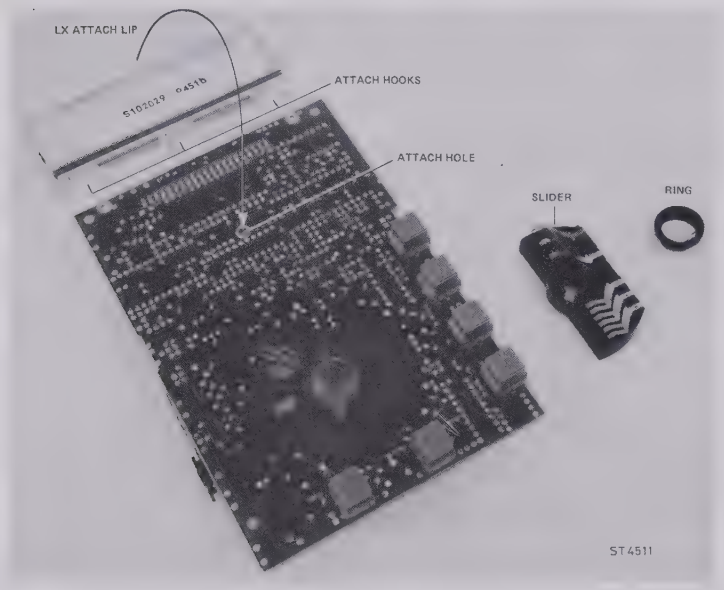


Fig. 3.4. Disassembling the parts on the p.c. board

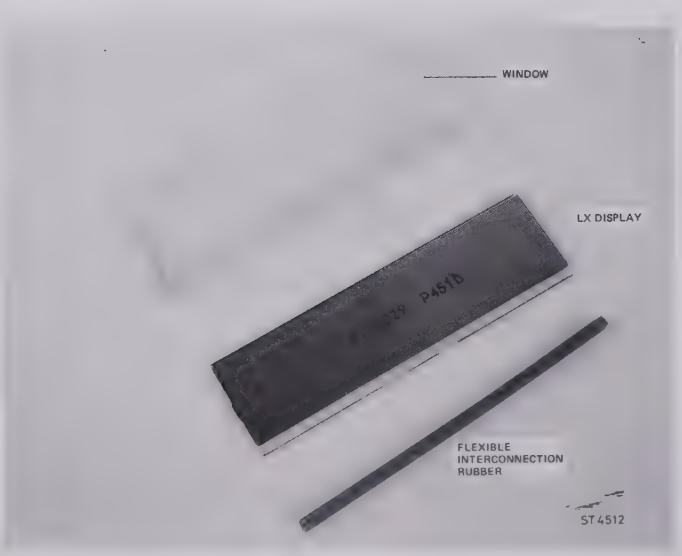
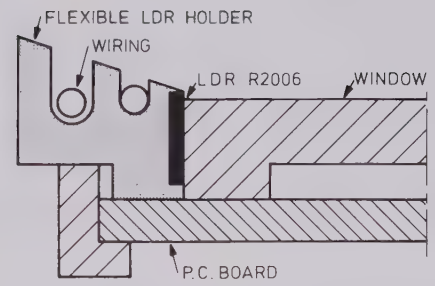
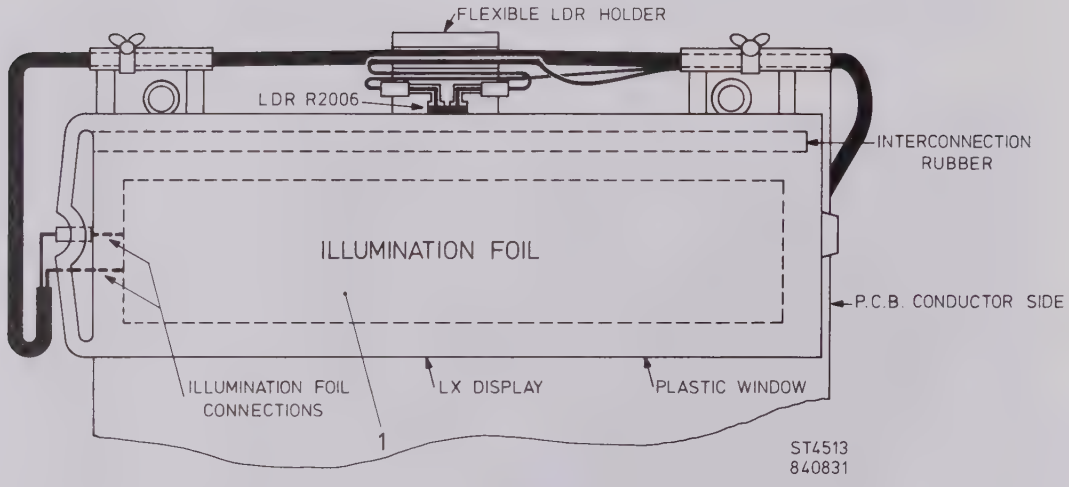


Fig. 3.5. Disassembling the LX-display





NOTE:

- *The service ordering number 5322 130 90183 LX assembly, contains:*
  - *The plastic window*
  - *The LX-display (without mirror).*
  - *The illumination foil glued on the LX-display.*
  - *LDR holder*
- *The legs of the components under the LX-display must be kept as short as possible. (⩽ 1 mm).*

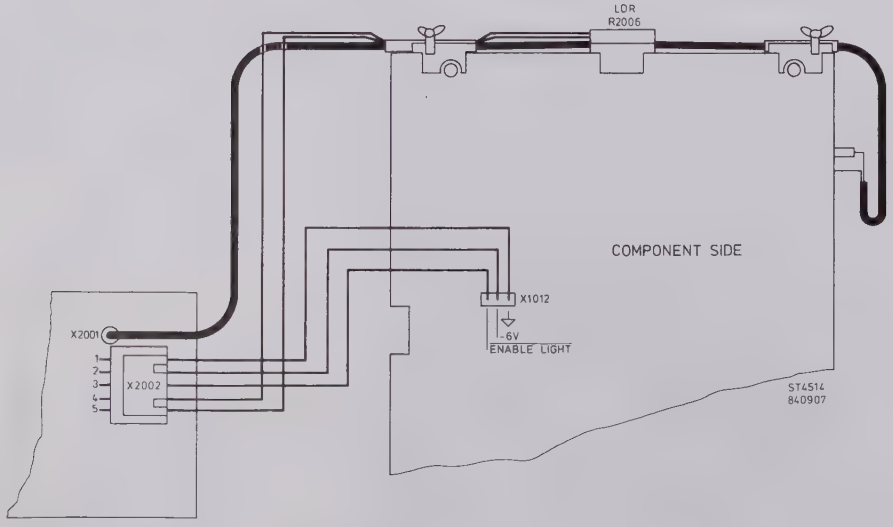


Fig. 3.6. Replacing the LX-display/11

3.2.4. Function selector and spring in the topcover /01/11

- Dismantle the PM2518X (refer to 3.1.).
- Lift the pc board out of the topcover (refer to 3.2.1.).
- Remove the screening out of the topcover (four screws).
- The function selector knob and the plastic spring are accessible now. (Fig. 3.7.).

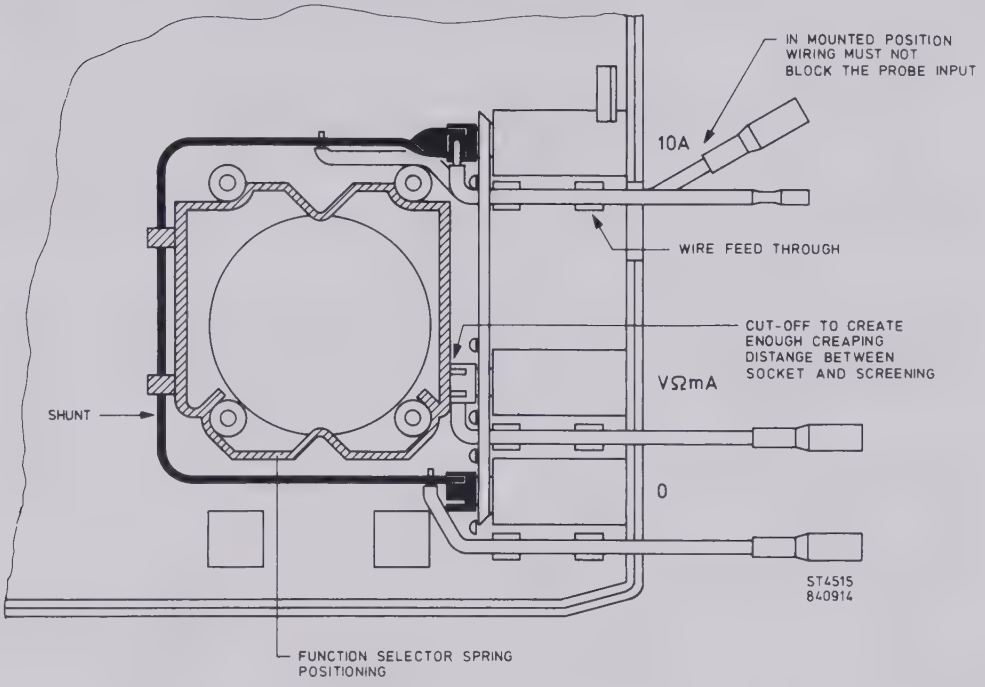


Fig. 3.7. Disassembling the function selector knob

3.2.5. Shunt and input sockets

If the shunt or input sockets are damaged they should be replaced by a complete new topcover assembly (including sockets, shunt assembly, spring function selector and screening).

4. CALIBRATION

4.1. GENERAL

The tolerance in this chapter correspond to the factory data, which only apply to a completely re-adjusted instrument. These tolerances may deviate from those mentioned in the Technical Data (Chapter 1).
For a complete re-adjustment of the instrument the sequence in this chapter should be adhered too.
When individual components, especially semi-conducters are replaced, the relevant section should be completely re-adjusted.

To calibrate this measuring instrument only reference voltages and measuring equipment with the required accuracy should be applied. If such equipment is not available, comparative measurements can be made with another calibrated PM2518X. However, theoretically the tolerances may be doubled in the extreme case.

The measuring arrangement should be such that the measurement cannot be affected by external influences. Protect the circuit against temperature variations (fans, sun).

With all the measurements the cables should be kept as short as possible at higher frequencies co-axial leads should be used.
Non-screened measuring cables act as aerials so that measuring instrument will measure HF voltage values or hum voltages.

Before calibrating remove the bottem cover.
For calibrating the instrument the adjusting elements are reachable at the back of the component side of the pc board.
However the display is situated at the conductorside and cannot be seen easily.
To make adjusting more comfortable a dummy display can be used (refer to 4.4.).

It is also possible to make a semi-automatic test and calibration set up with a controller and a programmable calibrator via the IEC-BUS/IEEE488-Bus interface PM9181 (refer to 5.5.).

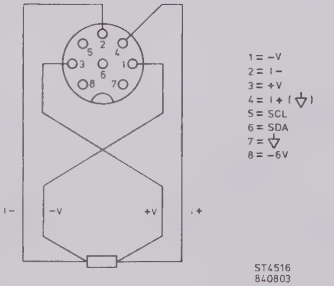
4.2. ADJUSTING TABLE

NO.	ADJUSTMENT	ADJUSTING ELEMENT	PREPARATIONS	INPUT SIGNALS	MEASURING DATA	MEASURING POINT
	General					
1.	Power supply		Instrument switched on Power; 4 x 1.5V batt. ; PM9248 (9V)		+ 7.5V – 7.5V	A1101 pt 24 A1101 pt 1
2.	Range 1 ADC	Adj. Resistor R1107; coarse (MR25 1% E48 SERIES) Potentiometer R1108; fine	Instrument set in position; V ⎓ AUTO	+ 100mV ± 0.001% supplied to MP2 and 0-socket.	+ 1000.0mV ± 1 dig.	Display
3.	Range 2 ADC	Potentiometer R1102	Instrument set in position; V ⎓ AUTO	+ 1V ± 0.001% supplied to MP2 and 0-socket	+ 10.000V ± 1 dig.	Display
	DC Volt. Range					
4.	Zero ADC	Trimmer C1108	Instrument set in position; V ⎓ AUTO	VΩmA and 0-socket short-circuited	+ 000.0mV ± 1 dig.	Display
5.	Calibration range 10.000V	Potentiometer R1206	Instrument set in position; V ⎓ AUTO	+ 10V ± 0.001% supplied to VΩ mA and 0-socket	+ 10.000V ± 1 dig.	Display
6.	Calibration range 100.00V	Potentiometer R1207	Instrument set in position; V ⎓ AUTO	+ 100V ± 0.001% supplied to VΩ mA and 0-socket	+ 10.000V ± 1 dig.	Display
	Checks V ⎓ ranges					
7.	Range 1000V	–	Instrument set in position; V ⎓ AUTO	+ 1000V ± 0.001% supplied to VΩ mA and 0-socket	+ 1000.0V ± 12 dig.	Display

NO.	ADJUSTMENT	ADJUSTING ELEMENT	PREPARATIONS	INPUT SIGNALS	MEASURING DATA	MEASURING POINT
	AC Volt ranges					
8.	Calibration range 10.000V ~	Adj. resistor R1310; coarse (MR25 1% E48 series) Potentiometer R1311; fine	Instrument set in position; V ~ AUTO	10V ± 0.01% 60Hz supplied to VΩ mA and 0-socket	10.000V ± 1 dig.	Display
9.	–	–	–	–	–	–
	Resistance ranges					
10.	Reference current of OQ0066	Adj. resistor R1407; coarse (MR25 1% E48 series)	Instrument set in position; Ω, range 1000.0Ω	1000Ω ± 0.01% supplied to VΩ mA and 0-socket	1000.0Ω ± 1 dig.	Display
11.	Compensation amplifier of OQ0066	Potentiometer R1404	Instrument set in position; Ω, range 10.000MΩ	10MΩ ± 0.01% supplied to VΩ mA and 0-socket	9.990 MΩ ± 2 dig.	Display
	Checks resistance ranges					
12.	Range 1kΩ	–	Instrument set in position; Ω, range 1000.0Ω	a) 1kΩ ± 0.01%	1000.0Ω ± 40 dig.	Display
	Range 10kΩ	–	Instrument set in position; Ω, range 10.000kΩ	b) 10kΩ ± 0.01%	10.000kΩ ± 4 dig.	Display
	Range 100kΩ	–	Instrument set in position; Ω, range 100.00kΩ	c) 100kΩ ± 0.01%	100.00kΩ ± 60 dig.	Display
	Range 1MΩ	–	Instrument set in position; Ω, range 1000.0kΩ	d) 1MΩ ± 0.01%	1000.0kΩ ± 60 dig.	Display
	Range 10MΩ	–	Instrument set in position; Ω, range 10.000MΩ	e) 10MΩ ± 0.01%	9.990MΩ ± 60 dig.	Display
	Range 100MΩ	–	Instrument set in position; Ω, range 100.0MΩ	f) 10MΩ ± 0.01% Supplied to VΩ mA and 0-socket	10.0MΩ ± 8 dig.	Display

NO.	ADJUSTMENT	ADJUSTING ELEMENT	PREPARATIONS	INPUT SIGNALS	MEASURING DATA	MEASURING POINT
	DC Current ranges					
13.	Calibration range 20mA ⎓	Potentiometer R1603	Instrument set in position; A ⎓, range 20.00mA	20mA ⎓ ± 0.2% supplied to VΩ mA and 0-socket	+ 20.00mA ± 12 dig.	Display
	Check DC current ranges					
14.	Range 200mA	–	Instrument set in position; mA ⎓, range 200.0mA	200mA ± 0.2% supplied to VΩ mA and 0-socket	+200.0mA ± 12 dig.	Display
	Range 2A	–	Instrument set in position; A ⎓, range 2.000A	2A ± 0.2% supplied 10A and 0-socket	+ 2.000A ± 12 dig.	Display
	AC current ranges					
15.	Calibration range 20mA	Potentiometer R1605	Instrument set in position; A ~, range 20.00mA	20mA~ ± 0.2% 60Hz supplied to VΩ mA and 0-socket	20.000mA ± 1 dig.	Display
	Check AC current ranges					
	Range 200mA	–	Instrument set in position; A~, range 200.0mA	200mA ± 0.2% 60Hz supplied to VΩ mA and 0-socket	200.0mA ± 18 dig.	Display
	Range 2A	–	Instrument set in position; A ~, range 2.000A	2A ± 0.2% 60Hz supplied to 10A and 0-socket	2.000A ± 18 dig.	Display

NO.	ADJUSTMENT	ADJUSTING ELEMENT	PREPARATIONS	INPUT SIGNALS	MEASURING DATA	MEASURING POINT
	Check ^{o}C					
16.		–	Instrument set in position ^{o}C	100Ω *NOTE: The resistance should be connected to points and of the probe input*	000.0^{o}C ± 10 dig.	Display
	Check H.F.					
17.		–	Instrument set in position; HF	+ 10V ± 0.001% supplied to VΩ mA and 0-socket	10.000V ± 12 dig.	Display
	Check diode					
18.		–	Instrument set in position; diode	1kΩ ± 0.01% supplied to VΩ mA and 0-socket	1000.0mV	Display
19.	Check dB and dB ZERO SET	–	Instrument set in position; V ~ range 10.000V	10V ± 0.01% 60Hz supplied to VΩ mA and 0-socket	10.000V	Display
			a) push dB button	"	+ 0222.2 dB	Display
			b) push ZERO button	"	+ 000.0 dB	Display



4.3. LDR ADJUSTMENT FOR /11 VERSION

Adjustment no. 20. LDR ADJUSTMENT

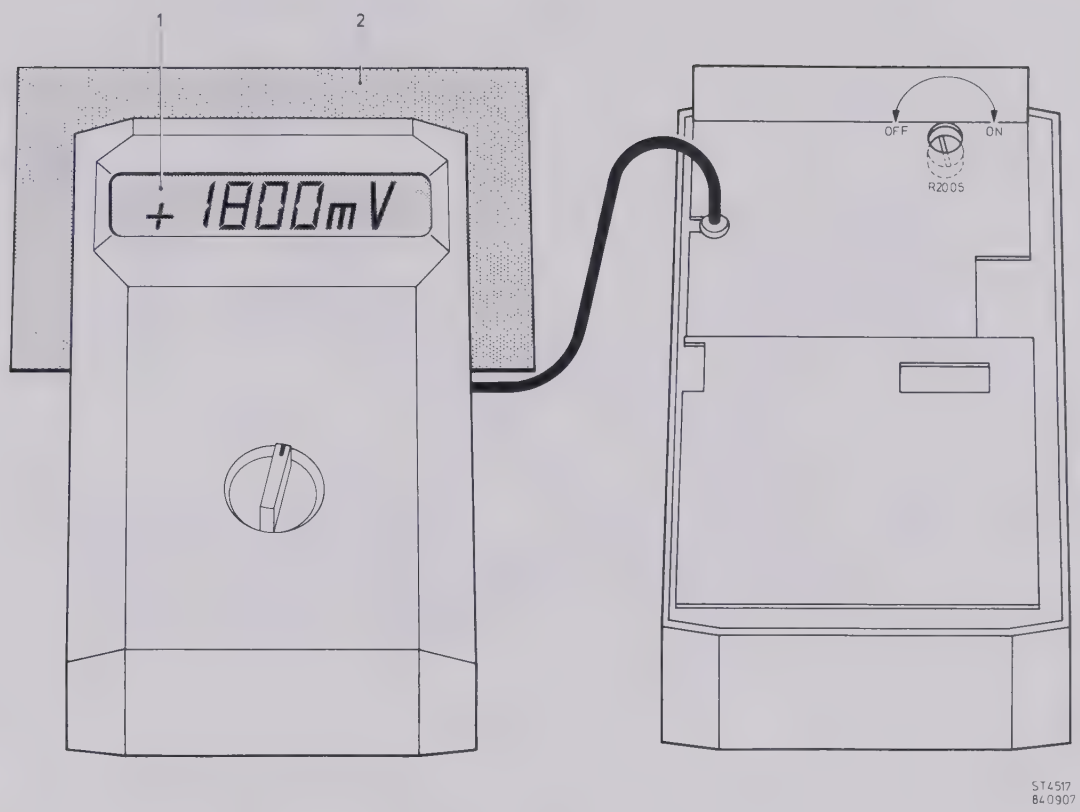


Fig. 4.1. LDR adjustment

- Place the topcover with display upwards.
- 1 Make sure that the LDR is placed in the correct position.
  Make sure that the display window is pressed firmly and correct to the topcover.
- 2 Press a piece of black material (foam, carton) to the back of the topcover.
- Adjust the illumination to **off** under normal light circumstances (switching-off point).
- Check **on, off** with a hand above the display.

4.4. TEST AND CALIBRATION SET-UP WITH "DUMMY DISPLAY"

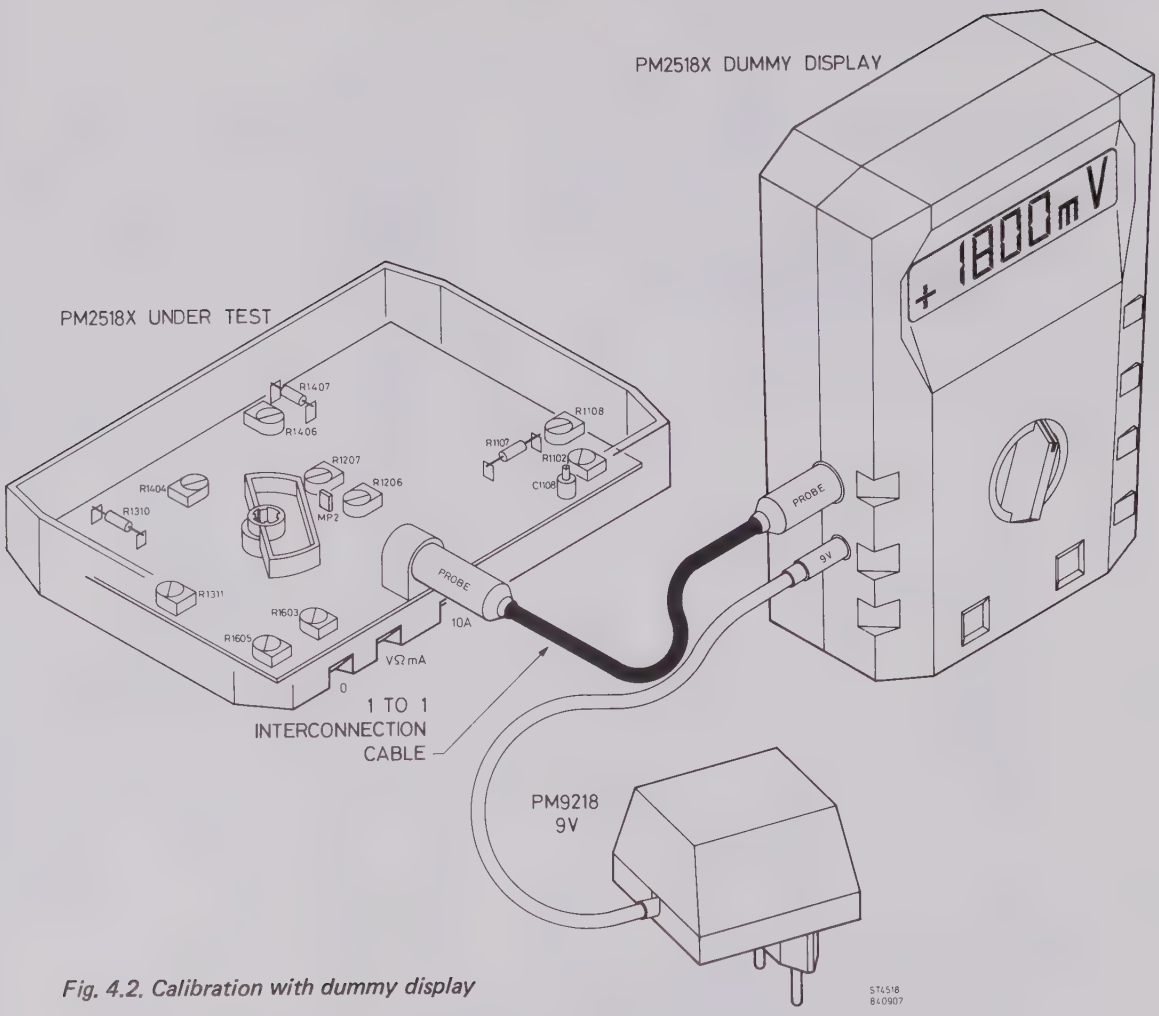


Fig. 4.2. Calibration with dummy display

HOW TO MAKE A "DUMMY DISPLAY" FROM A PM2518X

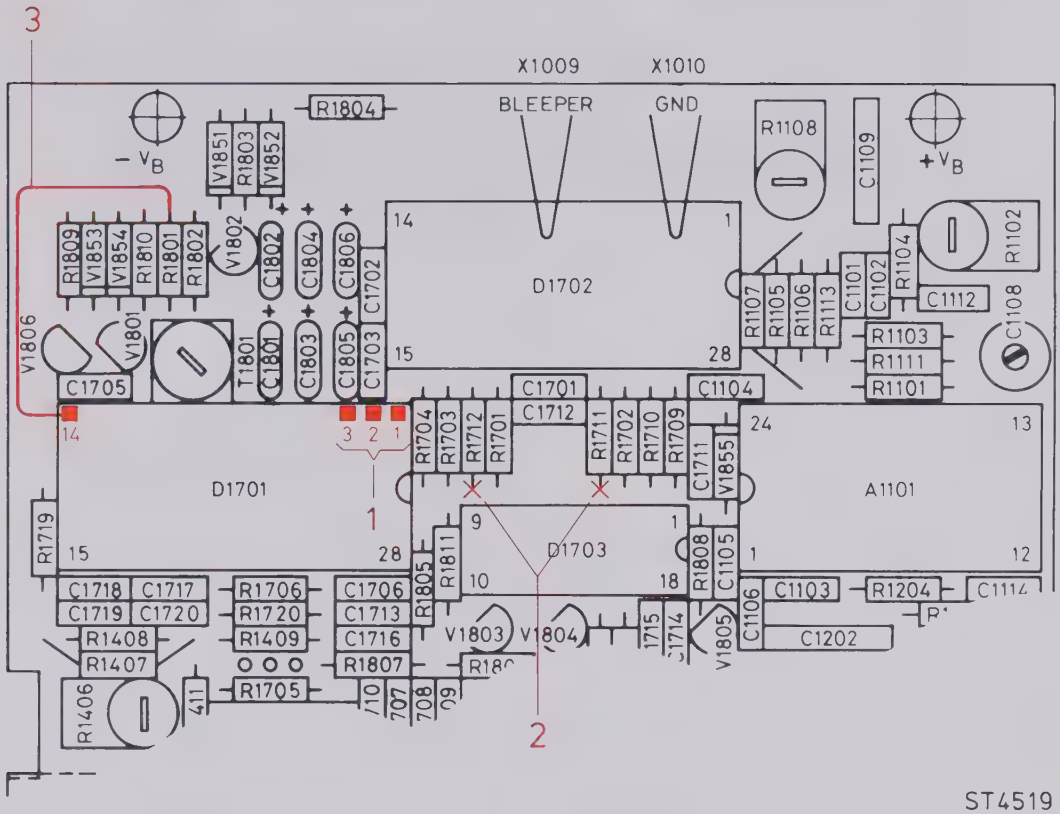


Fig. 4.3. Connections for dummy display

1) CUT PINS 1, 2, 3 OF THE μP D1701 (DISCONNECT μP).
2) LIFT ONE LEG OF R1711 AND R1712 (DISCONNECT OQ0071).
3) INTERCONNECT D1701/14 WITH R1801 (LOGIC 0 TO $\overline{EP}$).
4) MAKE A ONE TO ONE CABLE WITH TWO 8-POLE DIN PLUGS (5322 264 50121) AND FOUR WIRES.

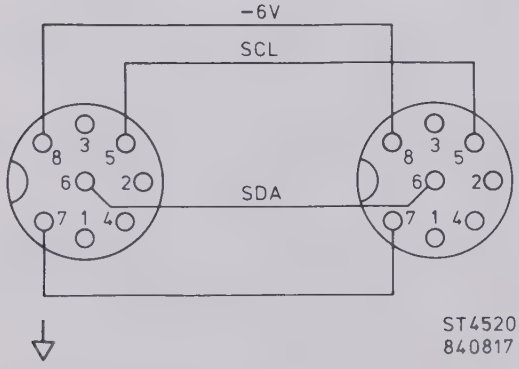


Fig. 4.4. I^2C interconnection cable

4.5. TEST AND CALIBRATION SET-UP WITH PM9181 I^2C — IEEE- BUS INTERFACE

4.5.1. Introduction

Using the PM9181 interface the PM2518X can be controlled by an IEEE-bus controller, including starting a measurement, reading out measurements and setting the range.

Also direct interfacing can be done with the processor of the PM2518X (for test purposes).
(The interface and the PM2518X communicate using the test level I^2C protocol).

4.5.2. Device programming

The following commands are understood:

HEADER	BODY	DESCRIPTION
V	j	Velocity: j = 0 Normal Velocity, Normal output format (default) 1 High Velocity, Short output format (last digit is multiple of 4)
V	1?	Ask velocity
R	i	Range: i = rangecode (see table)
R	1?	Ask range.
X	1	Execute: start measurement
F	1?	Ask measurement Function Sends header of output without waiting for the current measurement to terminate.
L	j	Send Automatic Cont: j = 0 Enable (default) 1 Disable

4.5.3. Measurement output data

Measurements are output as a Header/Body combination:

The first part of the header indicates the function switch position. This part of the header is always three characters in length, and separated by a space from the second part.

The second part of the header gives some additional information like Overload, Underload, Zero offset active or Crest factor exceded.

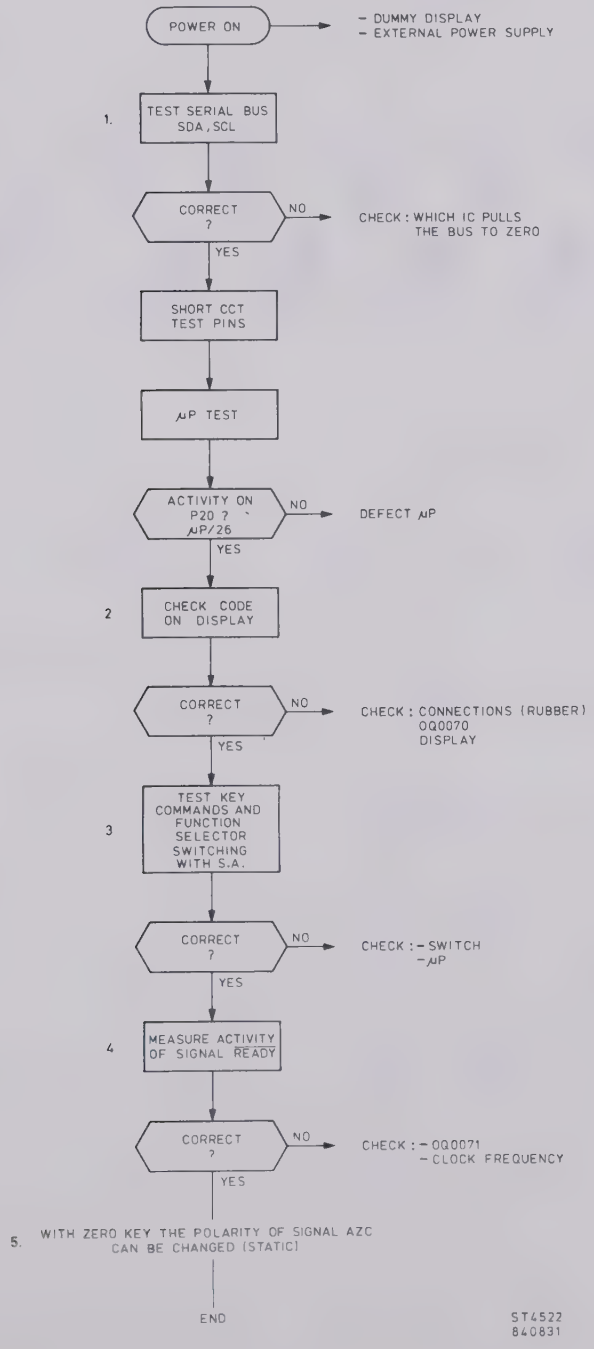
The body contains the range information.
If the device is in an overload condition, the measurement data is 99999, or –99999 for underload (dB only).

5. FAULT FINDING WITH BUILT IN TEST PROGRAMS

5.1. BRIEF DESCRIPTION OF THE TESTS

- After short circuiting the test pins the PM2518X will jump in its test routines.
- The first step is to test the µp itself (Ram & Serial I/O). If this test is correct the µp will generate start/stop pulses on P20. It will also generate a code for the display to test the connections.
- With the aid of a signature analyser now the reaction on key commands and function selector switching can be measured.
- With key zero the AZC signal for the ADC can be switched.
- The OQ0071 ADC interface can be tested by measuring the ready signal. The ready signal must be present for a defined time after pressing the zero key.

5.2. TESTS

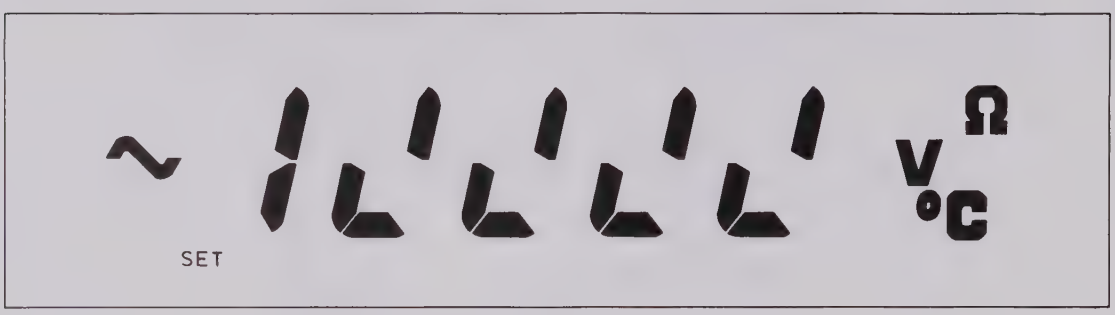


1) Measure on every IC (μp, OQ0070, OQ0071) connected to the bus the SDA and SCL signal, to see which IC pulls it to zero or one.

(Logic 0 = –6V Logic 1 = 0V)

Pinning	SDA	SCL	
μP	2	3	
OQ0070	15	16	
OQ0071	7	6	
DINBUS	6	5	For data hold probe PM9267

2) Display code (Short CCT Test pins, see print lay-out)



ST4523
840727

3) S.A.

– Set instrument in function H.F.
Connect the signature analyser (see print lay-out)

Trigger levels
CMOS 5V

START (–), STOP (+)	to R716	(μp P20)
CLOCK (–)	to R704	(CLOCK SCL)
GND	to –VB or R719	
DATA	to DIN-BUS /6	(DATA BUS SDA)

– Switch on the PM2518 and short CCT test pins (see print lay-out)
– Measure signatures

	SIGNATURES	
Function selector HF	HC0H	HC09
V ~	UC5U	UC5C
V ⎓	UU55	UU51
Ω	P362	P366
🔊 < 10 Ω	PU7F	PU78
°C	PC76	PC72
A ⎓	U741	U745
A ~	U34C	U34U
		↑ supply via dummy

	SIGNATURES	
Function selector HF	HC0H	HC09
and press ZERO	HC1H	HC19
UP	HC2H	HC29
DOWN	HC4H	HC49
AUTO	HC8E	HC88
dB	HA0U	HA0C
EXT POWER	HC0H	HC0H
LOW BATT	HC05	HC01
		↑ supply via dummy

4) $\overline{\text{READY}}$ SIGNAL

Measure if the ready signal is active. $\overline{\text{READY}}$ ⌐¬_⌐ on OQ0071/5 after pressing the ZERO key. This action can be repeated. If not, check the clock of the OQ0071 (activity).

5) When entering the test routines (short CCT test pins).
Signal AZC = LOGIC 1 (0V), static or LOGIC 0 (−6V).
With the ZERO key this can be altered to logic 0 (−6V) and visa versa.
This test is intended to be used to check both the ADC (OQ0067) input for leakage of internal and external FETS.

6. PARTS LIST PM2518X/01/11

6.1. MECHANICAL /01/11

Description	*Ordering code*	*Item*	*Fig.*	*Qty*
FRONT COVER				
Front cover assembly (incl. knob, shunt assy. screening, arret spring)	5322 447 70084	–	–	1
Socket assembly (plastic bridge with three sockets)	5322 263 40049	1	6.1.	1
Arret spring	5322 405 90281	2	6.1.	1
Function knob	5322 414 40026	3	6.1.	1
PC BOARD				
Rotor assembly (incl. contacts)	5322 362 20226	1	6.2.	1
Rotor ring	5322 532 60932	2	6.2.	1
Rotor insulation	5322 466 91519	5	6.2.	1
Pushbutton switch	4822 276 11076	3	6.2.	6
Pushbutton knob	5322 414 20075	4	6.2.	6
Print pen Hi/Lo/shunt	5322 268 14031	X1004/6/7	8.3.	3
Print pen 10A	5322 268 14156	X1005	7.3.	1
8P DIN socket	5322 267 54107	X1008	7.3.	1
Spring Bleeper/GND	5322 492 60349	X1009/10	7.3.	2
9V socket	5322 265 10043	X1015	7.3.	1
Fuse holder	5322 256 34097	F1001	7.3.	1
DISPLAY				
LX display /01 only (with mirror)	5322 130 90184	1	6.3.	1
Holder	5322 255 40372	2	6.3.	1
Interconnection rubber	5322 268 10197	3	6.3.	1

Description	*Ordering code*	*Item*	*Fig.*	*Qty.*
BOTTOM COVER				
Bottom cover (without feet, screening, battery springs)	5322 447 90433	1	6.4.	1
Battery spring +/–	5322 492 60347	2	6.4.	2
Battery spring interconn.	5322 492 60348	1	6.5.	2
Stand-up bracket	5322 462 40689	–	–	1
Probe shutter	5322 447 70082	4	6.4.	1
Battery cover assy. (incl. feet)	5322 443 61299	–	–	1
Rubber foot	5322 462 40691	3	6.4.	4
3 Fuse 630 mAF	4822 253 20015	–	–	1
Fuse 315 mAT	5322 253 24009	–	–	1
Bleeper	5322 280 10158	4	6.4.	1
MEASURING LEADS				
Set of measuring leads incl. pins and adaptors	5322 397 60086			
Test pin black	5322 264 20045			
Test pin red	5322 321 20046			
Lead black	5322 321 20572			
Lead red	5322 321 20573			
Adaptor black	5322 264 20052			
Adaptor red	5322 264 20051			
/11 ONLY MECHANICAL				
LX Display assembly (incl. LX holder, LX display, illumination foil, LDR holder)	5322 130 90183	1	6.6.	1
LDR/LX wiring	5322 321 20899	2	6.6.	1
Convertor pc board	5322 216 71007	–	7.4.	1

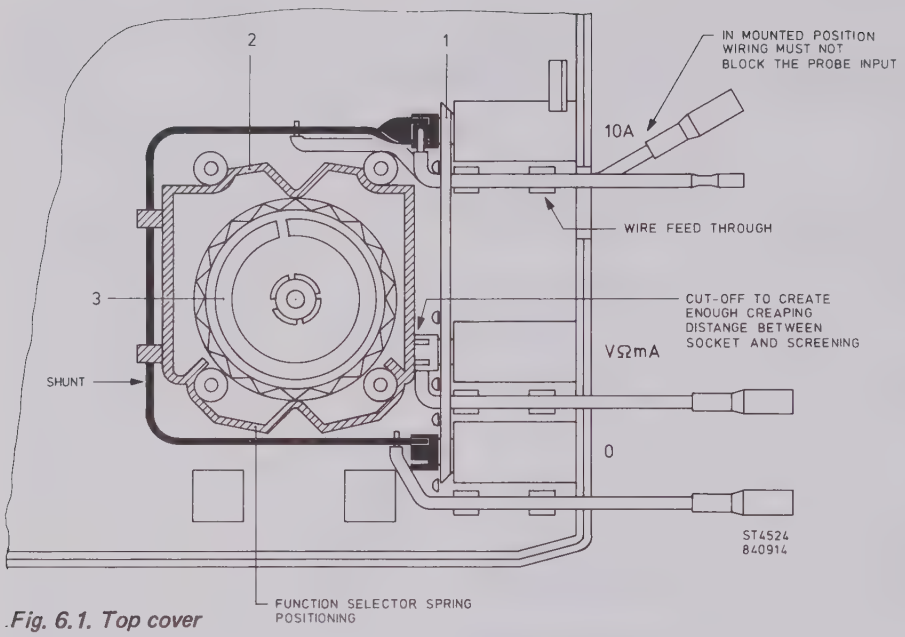


Fig. 6.1. Top cover

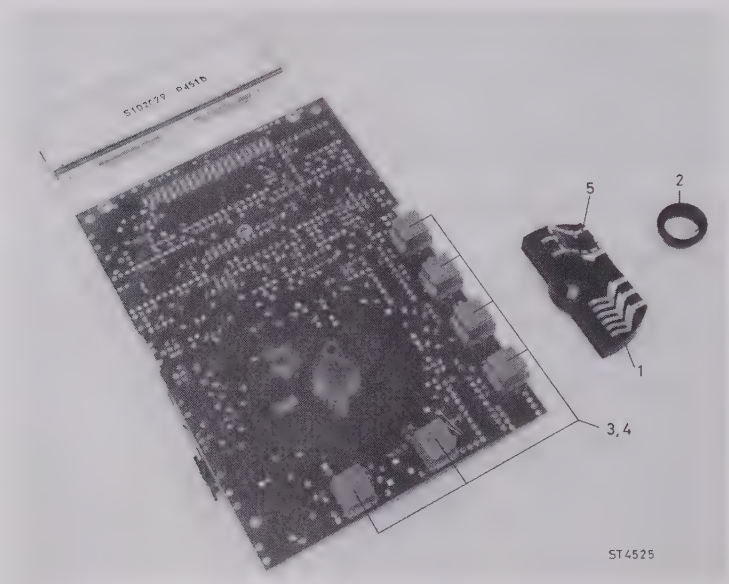


Fig. 6.2. Pc board

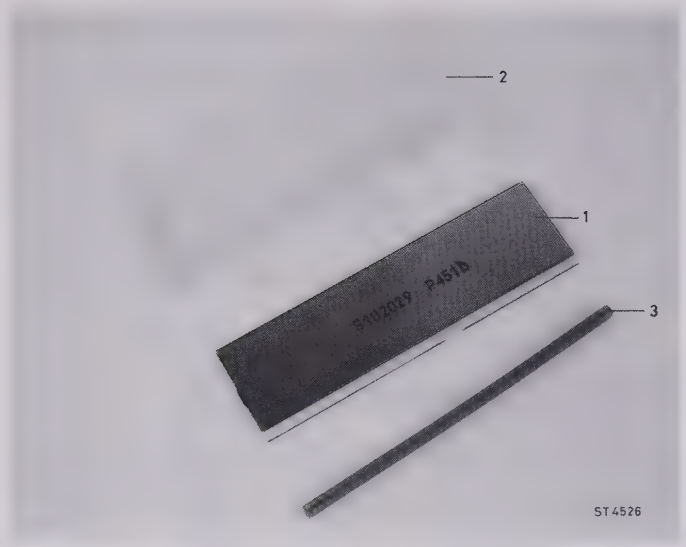


Fig. 6.3. LX display

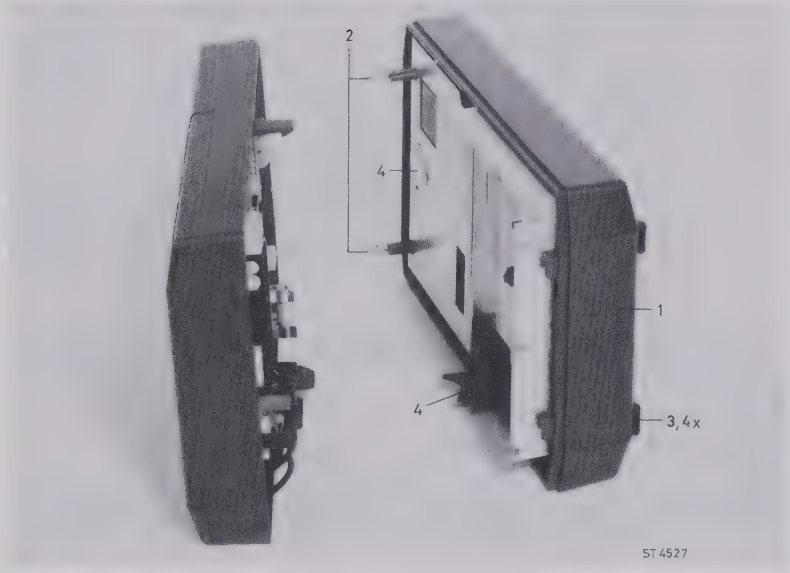


Fig. 6.4. Bottom cover

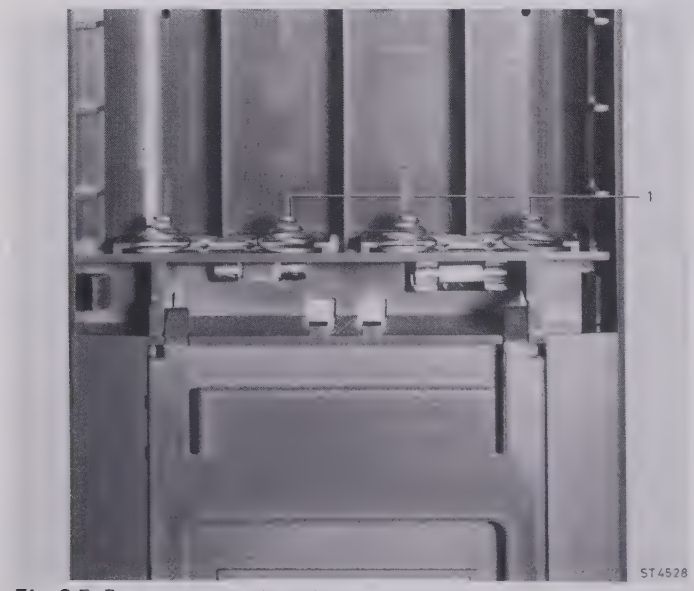
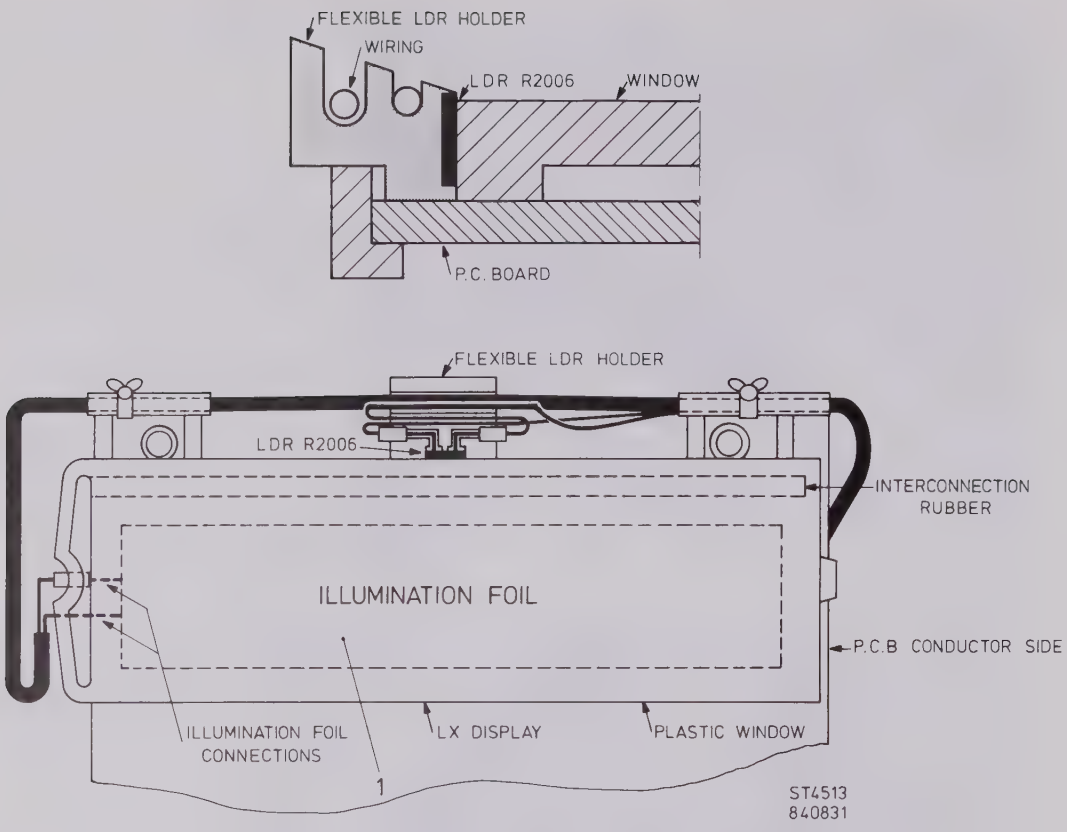


Fig. 6.5. Battery compartment



NOTE: ● *The service ordering number 5322 130 90183 LX assembly contains:*

- *the plastic window*
- *the LX display without mirror*
- *the illumination foil glued on the LX display*
- *LDR holder*

● *The legs of the components under the LX display must be kept as short as possible (⩽ 1mm).*

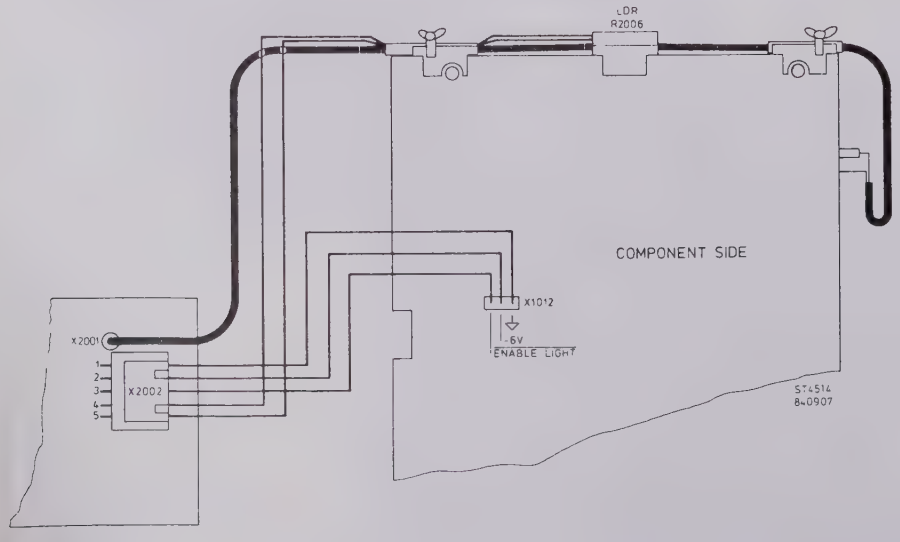


Fig. 6.6. LX display/11

6.2. ELECTRICAL /01/11

6.2.1. Integrated circuits /01/11

POSNR	DESCRIPTION	ORDERING CODE
A 1101	OQ0067A	5322 209 81883
A 1301	OQ0068A	5322 209 81884
A 1401	OQ0066A	5322 209 82081
D 1702	OQ0070	5322 209 82082
D 1703	OQ0071	5322 209 81901
D 1701	PCD 8520/002	5322 209 10932

6.2.2. Capacitors /01/11

POSNR	DESCRIPTION	ORDERING CODE
C 1101	2% 100PF	4822 122 31504
C 1102	2% 100PF	4822 122 31504
C 1103	-20+80% 22NF	4822 122 30103
C 1104	-20+80% 22NF	4822 122 30103
C 1105	-20+80% 22NF	4822 122 30103
C 1106	2% 47PF	4822 122 31244
C 1107	-20+80% 22NF	4822 122 30103
C 1108	250V 1.2/6PF	4822 125 50077
C 1109	250V 10% 47NF	5322 121 44138
C 1110	-20+80% 22NF	4822 122 30103
C 1111	-20+80% 22NF	4822 122 30103
C 1112	-20+50% 10NF	4822 122 31414
C 1113	2% 47PF	4822 122 31244
C 1114	0.25PF 3.3PF	4822 122 31041
C 1201	630V 5% 5.6NF	4822 121 50595
C 1202	400V 10% 33NF	5322 121 44025
C 1301	400V 10% 68NF	4822 121 42078
C 1302	0.25PF 4.7PF	4822 122 31189
C 1303	0.25PF 4.7PF	4822 122 31189
C 1304	10% 2.7NF	4822 122 30057
C 1305	100V 10% 680NF	5322 121 40233
C 1306	100V 10% 220NF	4822 121 40232
C 1307	10V 20% 15UF	5322 124 14036
C 1308	-20+80% 22NF	4822 122 30103
C 1309	-20+80% 22NF	4822 122 30103
C 1310	25V 20% 1UF	4822 124 20944
C 1311	2% 100PF	4822 122 31504
C 1312	10% 270PF	4822 122 30095
C 1401	250V 10% 22NF	4822 121 41587
C 1402	10% 1NF	4822 122 30027
C 1403	-20+80% 22NF	4822 122 30103
C 1404	-20+50% 10NF	4822 122 31414
C 1405	-20+80% 22NF	4822 122 30103
C 1406	-20+80% 22NF	4822 122 30103
C 1407	-20+50% 10NF	4822 122 31414
C 1701	-20+80% 22NF	4822 122 30103
C 1702	-20+80% 2.2NF	4822 122 30114
C 1703	-20+80% 22NF	4822 122 30103
C 1704	2% 100PF	4822 122 31504
C 1705	2% 100PF	4822 122 31504
C 1706	-20+80% 22NF	4822 122 30103
C 1707	-20+80% 22NF	4822 122 30103
C 1708	-20+80% 22NF	4822 122 30103
C 1709	-20+80% 22NF	4822 122 30103
C 1710	-20+80% 22NF	4822 122 30103
C 1711	-20+80% 22NF	4822 122 30103
C 1712	-20+80% 22NF	4822 122 30103
C 1713	-20+80% 22NF	4822 122 30103
C 1714	-20+80% 22NF	4822 122 30103
C 1715	-20+80% 22NF	4822 122 30103
C 1716	-20+80% 22NF	4822 122 30103

POSNR	DESCRIPTION	ORDERING CODE
C 1717	-20+80% 22NF	4822 122 30103
C 1718	-20+80% 22NF	4822 122 30103
C 1719	-20+80% 22NF	4822 122 30103
C 1720	-20+80% 22NF	4822 122 30103
C 1721	-20+80% 22NF	4822 122 30103
C 1801	25V 20% 1UF	4822 124 20944
C 1802	10V 20% 15UF	5322 124 14036
C 1803	10V 20% 15UF	5322 124 14036
C 1804	10V 20% 15UF	5322 124 14036
C 1805	10V 20% 15UF	5322 124 14036
C 1806	10V 20% 15UF	5322 124 14036

6.2.3. Resistors /01/11

POSNR	DESCRIPTION	ORDERING CODE
R 1101	0.1% 1K78	5322 116 51776
R 1102	0.05W 20% 100E	4822 100 10075
R 1103	0.1% 17K8	5322 116 52387
R 1104	MR25 1% 30E1	5322 116 50904
R 1105	0.1% 8K76	5322 116 52117
R 1106	MR25 1% 1K15	5322 116 50415
R 1107	MR25 1% 196K	5322 116 55364
R 1108	0.05W 20% 100K	4822 100 10052
R 1109	MR25 1% 61K9	5322 116 50872
R 1110	MR25 1% 110K	5322 116 54701
R 1111	VR25 5% 7M5	5322 116 60131
R 1113	MR25 1% 61K9	5322 116 50872
R 1201	SPEC 0.25% 4M53	5322 116 52126
R 1202	SPEC 0.25% 4M53	5322 116 52126
R 1203	0.1% 7K57	5322 116 52118
R 1204	0.1% 825K	5322 116 52119
R 1205	0.1% 825K	5322 116 52119
R 1206	0.05W 20% 100K	4822 100 10052
R 1207	0.05W 20% 100E	4822 100 10075
R 1208	MR30 1% 110K	5322 116 55485
R 1301	VR37 1% 1M	4822 110 42187
R 1302	VR37 1% 1M	4822 110 42187
R 1303	0.1% 196K	5322 116 52386
R 1304	0.1% 1K803	5322 116 52388
R 1305	MR25 1% 22K6	5322 116 50481
R 1306	0.1% 3K01	5322 116 51777
R 1307	0.1% 30K1	5322 116 51781
R 1308	MR25 1% 23E7	5322 116 54014
R 1309	MR25 1% 10K5	5322 116 50731
R 1310	MR25 1% 127K	5322 116 54706
R 1311	0.05W 20% 1K	4822 100 10037
R 1312	MR25 1% 100K	4822 116 51268
R 1313	MR25 1% 196K	5322 116 55364
R 1401	245V 750E-1K5	5322 116 44006
R 1402	VR25 1% 10M	5322 116 51786
R 1403	MR25 1% 28K7	5322 116 55462
R 1404	0.05W 20% 470E	4822 100 10038
R 1405	MR25 1% 28K7	5322 116 55462
R 1406	0.05W 20% 47K	4822 100 10079
R 1407	MR25 1% 147K	5322 116 54712
R 1408	MR25 1% 16K9	5322 116 54635
R 1409	0.1% 121K	5322 116 51774
R 1410	245V 750E-1K5	5322 116 44006
R 1411	MR25 1% 215K	5322 116 54728
R 1412	245V 750E-1K5	5322 116 44006
R 1601	1W 20% 50E	4822 116 30008

POSNR	DESCRIPTION	ORDERING CODE
R 1602	1% 1E0	5322 113 21004
R 1603	0.05W 20% 100E	4822 100 10075
R 1604	MR25 1% 1K47	5322 116 50635
R 1605	0.05W 20% 2K2	4822 100 10029
R 1606		5322 405 90282
R 1701	MR25 1% 1M	5322 116 55535
R 1702	MR25 1% 90K9	5322 116 54694
R 1703	MR25 1% 100E	5322 116 55549
R 1704	MR25 1% 100E	5322 116 55549
R 1705	MR25 1% 1M	5322 116 55535
R 1706	MR25 1% 100K	4822 116 51268
R 1707	MR25 1% 1K	4822 116 51235
R 1709	MR25 1% 24K9	5322 116 54648
R 1710	MR25 1% 24K9	5322 116 54648
R 1711	MR25 1% 100E	5322 116 55549
R 1712	MR25 1% 100E	5322 116 55549
R 1713	MR25 1% 100E	5322 116 55549
R 1714	MR25 1% 100E	5322 116 55549
R 1715	MR25 1% 100K	4822 116 51268
R 1716	MR25 1% 402K	5322 116 55283
R 1717	MR25 1% 100K	4822 116 51268
R 1718	MR25 1% 100K	4822 116 51268
R 1719	MR25 1% 5K11	5322 116 54595
R 1720	MR25 1% 1K	4822 116 51235
R 1801	MR25 1% 46K4	5322 116 50557
R 1802	MR25 1% 1K05	5322 116 54552
R 1803	MR25 1% 10E	5322 116 50452
R 1804	MR25 1% 10E	5322 116 50452
R 1805	MR25 1% 953K	5322 116 51368
R 1806	MR25 1% 147K	5322 116 54712
R 1807	MR25 1% 442K	5322 116 55458
R 1808	MR25 1% 2K49	5322 116 50581
R 1809	MR25 1% 1E	4822 116 51179
R 1810	MR25 1% 1E	4822 116 51179
R 1811	MR25 1% 10K5	5322 116 50731

6.2.4. Semiconductors /01/11

POSNR	DESCRIPTION		ORDERING CODE
V 0451	BAX12A	PH	5322 130 34605
V 1201	BF256B	PH	5322 130 44744
V 1202	BF256B	PH	5322 130 44744
V 1301	BF256B	PH	5322 130 44744
V 1302	BF256B	PH	5322 130 44744
V 1452	BAX12A	PH	5322 130 34605
V 1453	BZX87-C5V1	PH	5322 130 34425
V 1801	BC559B	PH	4822 130 44358
V 1802	BC549C	PH	4822 130 44246
V 1803	BC549C	PH	4822 130 44246
V 1804	BC559B	PH	4822 130 44358
V 1805	BC549C	PH	4822 130 44246
V 1806	BC547B	PH	4822 130 40959
V 1851	BAX12A	PH	5322 130 34605
V 1852	BAX12A	PH	5322 130 34605
V 1853	BAW62	PH	4822 130 30613
V 1854	BAW62	PH	4822 130 30613
V 1855	BZX79-C4V3	PH	4822 130 31346

6.2.5. X-tal /01/11

POSNR	DESCRIPTION	ORDERING CODE
B 1701	CSB455E MU	5322 242 7028

6.3. Electrical /11 only

POSNR	DESCRIPTION	ORDERING CODE
C 2001	-10+50% 220UF	5322 124 24189
C 2002	-20+80% 22NF	4822 122 30103
C 2003	-20+80% 22NF	4822 122 30103
D 2001	HEF4093BD PH	5322 209 14927
L 2001	10MH	5322 158 10304
R 2001	MR25 1% 10K	4822 116 51253
R 2002	MR25 1% 10K	4822 116 51253
R 2003	MR25 1% 6K19	5322 116 55426
R 2004	MR25 1% 2K49	5322 116 50581
R 2005	0.05W 20% 100K	4822 100 10052
R 2006	RPY58A PH	4822 130 31373
T 2001	OR TFE2010	5322 144 10067
V 2001	BC549C PH	4822 130 44246
V 2002	BC549C PH	4822 130 44246
V 2003	BC549C PH	4822 130 44246
X 2001		5322 268 14141
X 2001		5322 268 24116

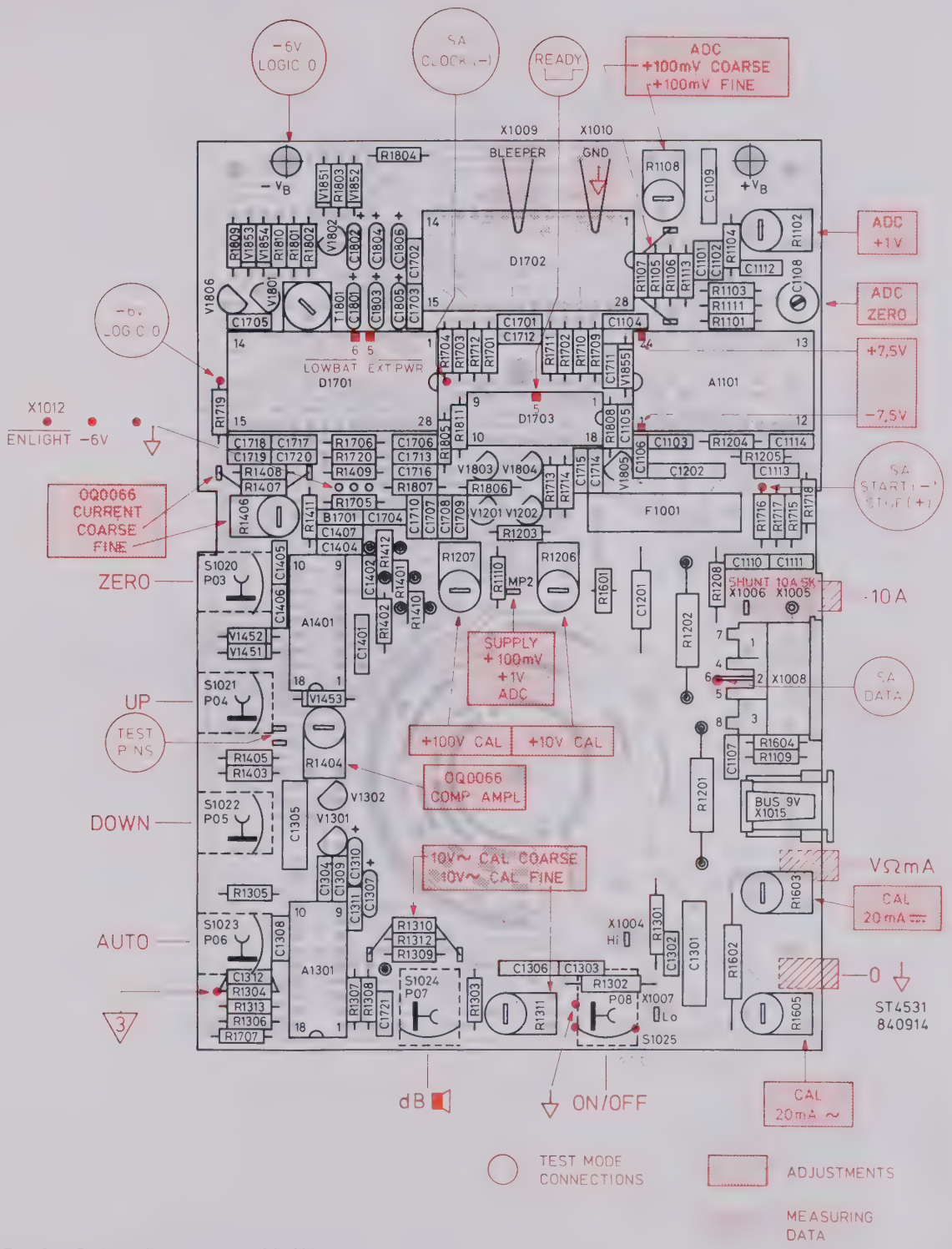


Fig. 7.3. Pc board component side N1

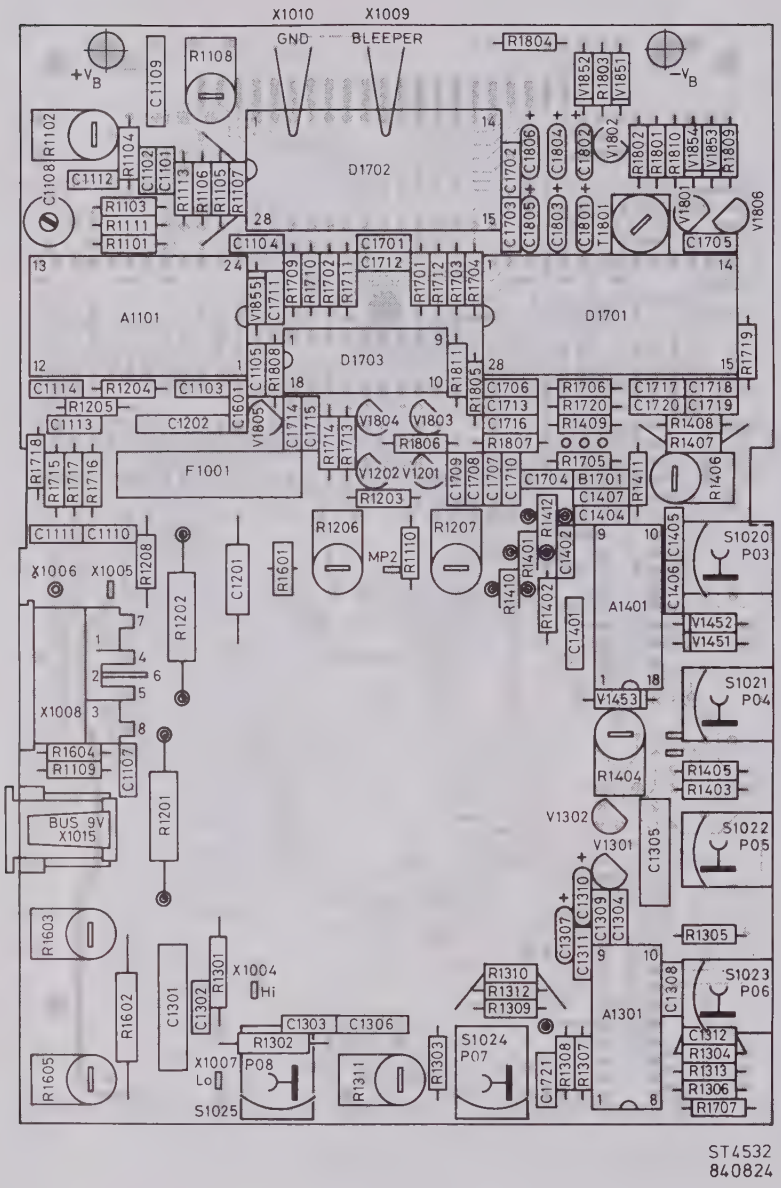


Fig. 7.4. Pc board conductor side

8. MODIFICATIONS

Re: This chapter describes the PM2518X modifications and applications up to the date mentioned on the front of this service manual.

Service note SME120 is included in this modification chapter.

Contents:

Remark; Headings marked with ▽ also point to the circuit diagrams.

1. Misindication when input voltage is supplied to the input (about 10 %)
2. Incorrect ON switching; Fuses; AC accuracy
3. APPLICATION to increase the illumination on time (backlite)
4. APPLICATION rechargeable batteries power supply
5. Unsmooth running of the function selector
6. Missing segments in LX-display
7. Incorrect switching of function selector on p.c. board
8. Flash-over on printed circuit board, after the 315 mA has been blown, due too small creepage distance
9. Difficult mounting of batteries
10. Better adjustment of the ADC
11. Survey General, new p.c. board
12. Flashover between input wiring and top cover screening
13. Difficult connection of the probes
14. Zero drift
15. Mounting of transistors V1201, V1202, V1803, V1804

1. ▽1 **Misindication when input voltage is supplied to the input (about 10 %).**

CAUSE : Leaking FETs in OFF STATE . V1201/02/1301/02 BF256C

REMEDY : FETs replaced by BF256B 5322 130 4474

NOTE: In the first 300 instruments /01/11 the modification is occasionally built in:
(DY01 00600-DY01 00900)
(DY11 00600-DY11 00900)

2. ▽2 **Incorrect ON switching; Fuses; AC accuracy.**

PROBLEM : Instrument does not switch on when a 9 V power supply PM9218 is used. (μp damaged)

CAUSE : Too high supply voltage for the μp (dependent on the power supply). No signal EP generated. The power supply does not switch on.

REMEDY : Zener diode V1855 BZX79-C3V0 in the power supply circuit replaced by a BZX79-C4V3 4822 130 31346.

NOTE: In the first 300 instruments /01/11 the modification is occasionally built in:
(DY01 00600-DY01 00900)
(DY11 00600-DY11 00900)

▽3 The first 500 instruments are equipped with a 315 mAT slow blow fuse.
From DY 1150 on a 630 mAF fast fuse is used with ordering number 4822 253 20015.

▽4 C1312 220 to 270 pF 10% 100 V ceramic plate in parallel with C1304, R1304 to get 100 V 10 kHz within tolerance.

3. 5 **Application to increase the illumination-on time (backlite).**

To increase the 30s. illumination-on time there are three possibilities:

1. External 9 V power supply (PM9218)
   The light stays on continuously in low light levels.

2. Battery power supply and signal $\overline{\text{EXTPWR}}$ conneceted to logic zero (–6 V).
   The light stays on continuously in low light levels as in 1.

3. Battery power supply and signal $\overline{\text{ENLIGHT}}$ connected to signal $\overline{\text{EP}}$.
   The light stays on for 30 minutes in the low light levels.
   This is in parallel with the display on time of 30 minutes.

For modification refer to the figures 8.1. and 8.2.

Fig. 8.1. 30 min. modification on p.c. board

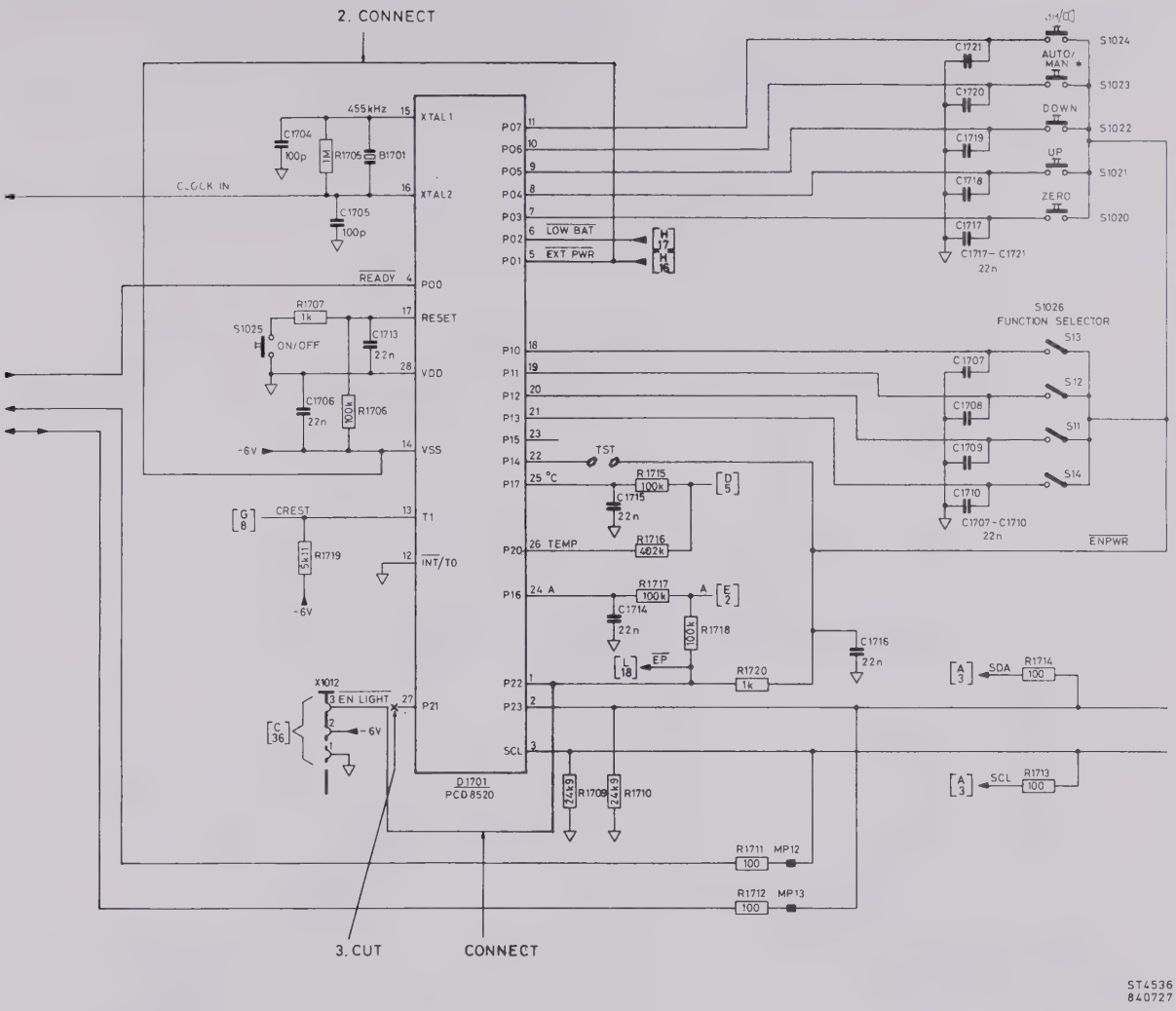


Fig. 8.2. 30 min. modification

4. 6 Rechargeable batteries power supply application.

The PM2518X delivered from the factory are wired for dry-cell batteries power supply and for 9 V external power supply using the PM9218.
For rechargeable batteries the circuitry inside the instrument has to be modified.

NOTE: If wired for rechargeable batteries dry-cell batteries should not be used. The 9 V external power supply will damage the batteries.

For modification proceed as follows:

1. Short-circuit the switch of the 9 V power supply input.

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2. Replace zenerdiode V1855 BZX79 C3V6 by a resistor of 36E5 Ω 1 % MR25 ordering number 5322 116 50409.

3. Mount a zenerdiode type BZX87 C6V2 between the power supply (+9 V and ZERO), ordering number 5322 130 34067 at the conductor side of the p.c. board.

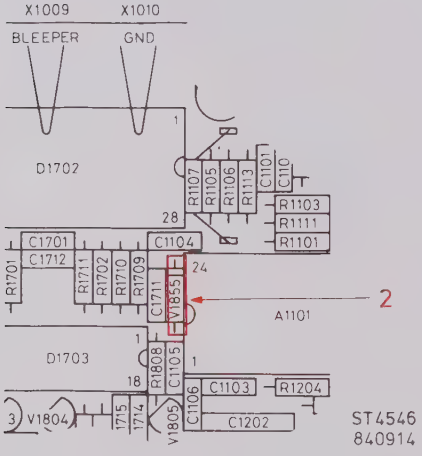


Fig. 8.3. P.c.b. component side

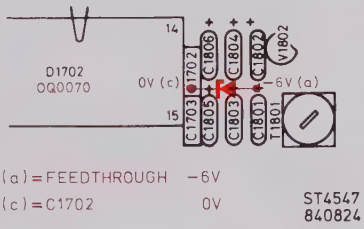


Fig. 8.4. P.c.b. conductor side

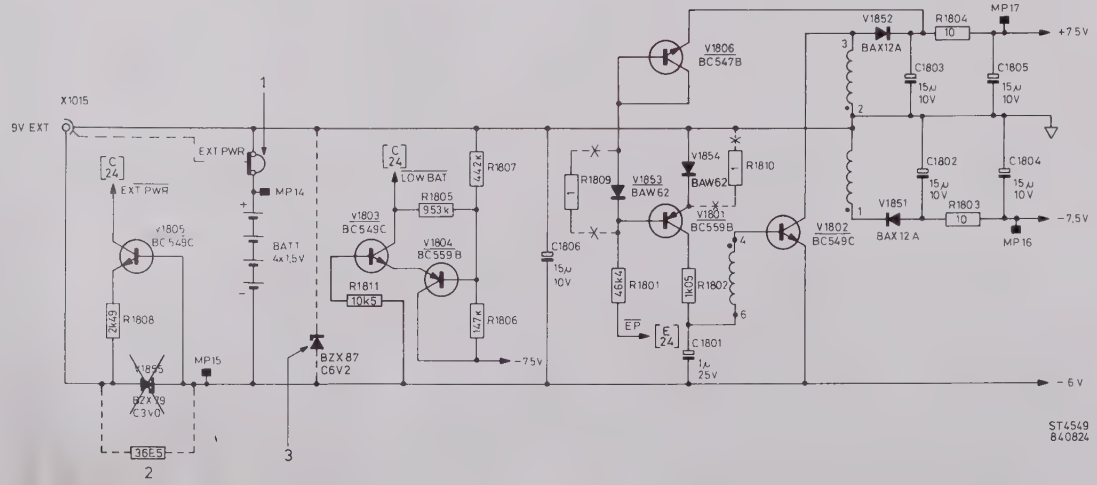
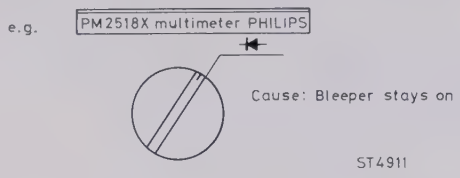


Fig. 8.5. Circuit diagram power supply

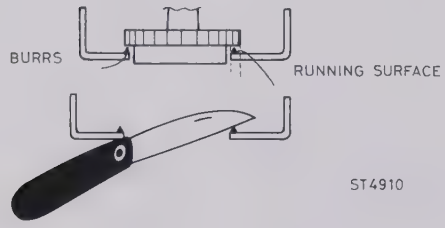
5. Unsmooth running of the function selector.

PROBLEM : Function switch does not jump back in its rest position



CAUSE : a. Burrs around the function selector hole in the topcover.
b. Not correct mounted shunt by which the plastic switching spring gets stuck between shunt and function selector knob.
c. Burrs around the function selector hole in the screening, too tight mounted screening or bent screening.
d. Bad going function selector part on the p.c. board (scratching) caused by burrs or too small hole.

REMEDY : a/b Removal of burrs and correct mounting of shunt
– Remove screening from topcover
– Remove function selector and spring from the topcover
a. Remove burrs from the topcover e.g. with a knife



Remarks: – Take care that the running surface is not scratched.
– The burrs are sometimes very small.
– Clean the running surface to remove all burr rests.

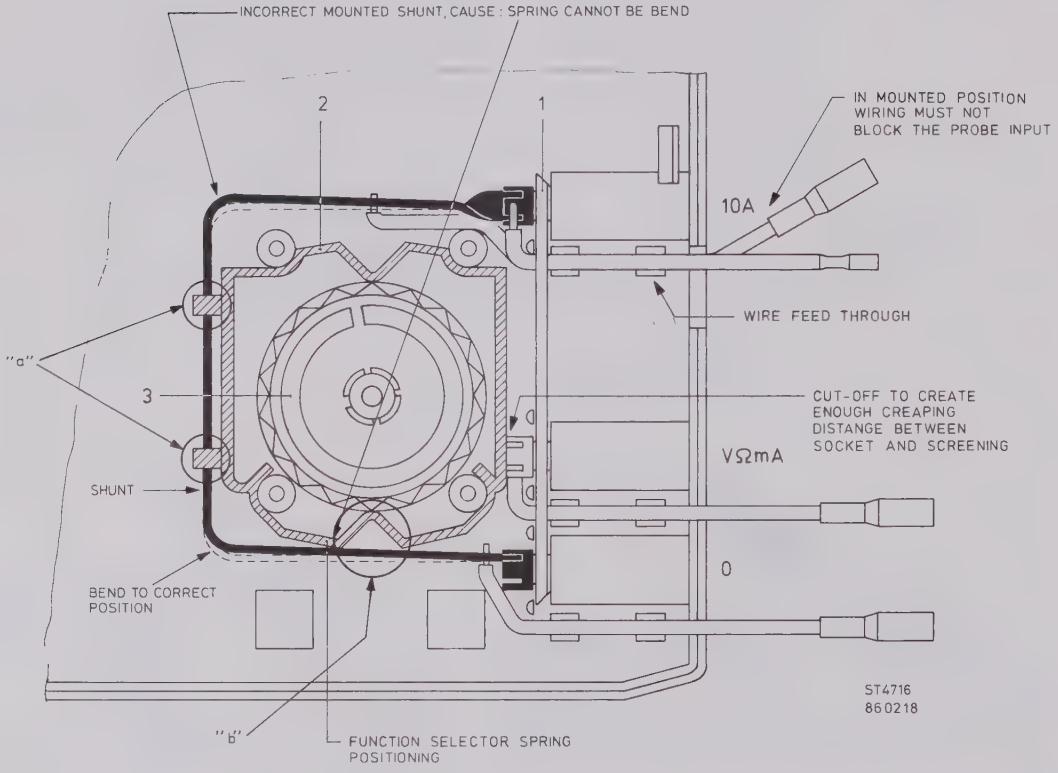
Place the function selector knob in the topcover and feel that it runs smoothly.

b. Remove the function selector knob.

Place the plastic spring in the topcover and mind the following:
The spring must be mounted without any torsions. It must fall free over the shunt.

If incorrect mounted on the following points unwanted torsions may occur.
- In rest position on points "a"
- In switch position on point "b"
  (Spring stuck between selector and shunt)

Bent the shunt in such a way that no torsions occur.

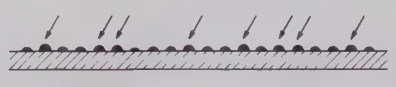


c. Screening
- Remove burrs around the function selector hole.
- Straigten the screening.
- Mount the screening not too tight.

d. P.c. board
- Remove burrs around the function selector hole.
- File the hole untill the selector runs smoothly.

6. Missing segments in LX-display.

CAUSE : Bad/irregular LX-contacts on the p.c. board due to solder.



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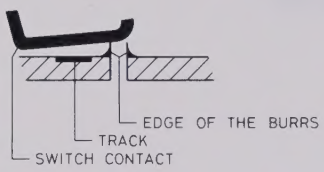
REMEDY : Phase 1 = For instruments in the field already.
- Resolder the contacts to get them at the same height.
- Clean the contacts with a hard brush.
- Mount a new thicker interconnection rubber 4,4 mm. (C.S. cdnr. 5322 268 10197)

Phase 2 = Modifications already built-in by the factory from march 1985 on.
- During the soldering process (solder bath) the LX-contacts are covered with tape. No additional solder will spoil the contacts.
- Thicker interconnection rubber 4,4 mm to increase pressure. (C.S. cdnr. 5322 268 10197)

Phase 3 = From serial number PM2518X/01 DY 11226, PM2518X/11 DY 3900 on, a new printed circuit board is mounted.

7. Incorrect switching of function selector on p.c. board.

CAUSE : a. Too small track switching contacts.
b. Burrs around the creepage holes. (function Ω , ⊣⊢ , °C)



ST4717
850627

REMEDY : a. New printed circuit board with modified contact pattern valid from serial number PM2518X/01 DY 11226, PM2518X/11 DY 3900 on.
b. Remove the burrs.

8. Flash-over on printed circuit board, after the 315 mA has been blown, due too small creepage distance.
creepage distance.

CAUSE : Too small creepage distance if the voltage over the blown fuse becomes too high. (peaks > 1000 V)

ST4718
850627

REMEDY : New printed circuit board with modified tracks (larger creepage distance) from serial number PM2518X/01 DY 11226, PM2518X/11 DY 3900 on.

9. Difficult mounting of batteries.

CAUSE : Battery springs.

REMEDY : An additional spring over the battery contacts, ordering number 5322 290 60571

10. Better adjustment of the ADC.

Improvement : For a better adjustment of the ADC.
The following resistors have been modified.

R1108 100k to 10k	4822 100 11035
R1106 1k15 to 1k21	5322 116 54557
R1113 61kg to 20k5	5322 116 54643

11. Survey General, new p.c. board.

Survey General : New printed circuit board from serial number PM2518X/01 DY 11226, PM2518X/11 DY 3900 on.
- Gold LX contact (2)
- Larger switch contacts (7)
- Larger creeping distance (8)

12. Flashover between input wiring and top cover screening.

CAUSE : Too small holes in the topcover screening.
The screen cuts through the wire insulation.

REMEDY : Modified screening from serial number PM2518X/01 DY 11226, PM2518X/11 DY 3791 on.
Larger holes to
Shorter fastons.

13. Difficult connection of the probes.

CAUSE : Input socket not right angled mounted.

ST4737
850627

REMEDY : Right mounting.

14. Zero drift.

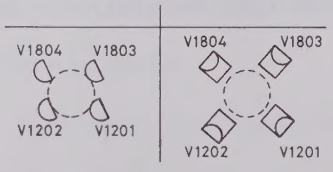
CAUSE : Dirty p.c. boards. Salt particles.
The salt will absorb humidity.

REMEDY : – Clean the p.c. board with parts in deionised water (water will dissolve the salt).
Immerse the p.c. board completely. Check the amount of salt in the water used.
– Dry the p.c. board forced.

15. Mounting of transistors V1201, V1202, V1803, V1804.

PROBLEM : With the new backcover (from PM2618X/PM2718X)
The stand-up around the test-hole touches the transistors.
This may cause switching problems.

REMEDY : Bend down the transistors.



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